-he OOL ENGINEER

OCTOBER 1954

Chip Control

BLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

10,000 TONS AT A MILE A MINUTE!

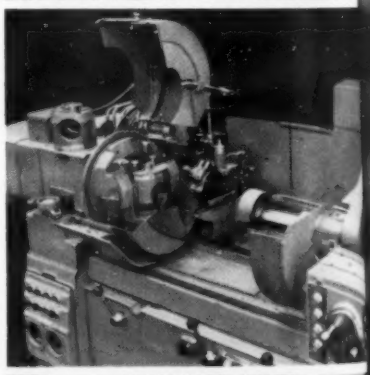
... it will get where it's going a little sooner, a little safer, because this part got the FULL HEALD TREATMENT

You're hitting the high iron at 60 per, with ten thousand tons of fast freight behind you. The huge, smoothly-purring diesels at your command have ample power and stamina to pull this tremendous load for hundreds of miles—with no interruptions, no unscheduled stops.

The tremendous power and long-haul dependability of modern diesel locomotives are a tribute to the skill and ingenuity of their makers. And precision finishing on Heald machines adds much to the stamina and perfect functioning of many vital diesel parts. Here, for example, is a piston pin carrier that is processed on *all three* basic Heald machines—as shown at the right.

Whenever a part is precision finished on Heald equipment you can be sure of three things. A finer, longer-lasting, precision made part. Important savings in time and production cost. A definite competitive advantage for your product. That's why IT PAYS TO COME TO HEALD.

Model 321 end loading Heald Bore-Matic is arranged to semi-finish piston pin holes in the forged steel carriers. Work is held in a two-station hydraulic clamping fixture and radial locaters are interlocked to insure proper location before machine is started.



Model 272 Gage-Matic Internal finish grinds the piston carriers. The work is held in an angle plate fixture with hand clamping; location is by pins in locating holes in piston carrier skirt. Workhead spindle positioning units are furnished so that loading will be from one position at all times.

Model 261 Rotary Surface Grinder finishes the shoulder of the piston pin carrier to provide flat smooth surface for locating on the inside dome of the diesel piston. The work is held on a radial pole magnetic chuck with a retainer ring. Machine operates on a standard operating cycle.

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

Cover: Critical feed, when chips become fragments in turning operations, is the subject of the article beginning on page 37. The article discusses the relationship between feed and depth of cut for chip control and proposes a new criterion of machinability.

The Tool Engineer

Volume XXXIII, No. 4 October 1954

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THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*

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The Tool Engineer

When the Chips Are Down

When it has become necessary to produce goods either in increased quantity during wartime or at lower cost during a competitive economy, tool engineers have met the challenge. When the chips were down, no matter the cause, these engineers have always been dependable. Their resourcefulness, ingenuity and genius are and always will be our bulwark in crises.

Apparently we are nearing the end of, or have just passed through, a period of economic stress equivalent to the recession of 1948. Our most dependable barometers—the three indexes for lagging, coincident and leading business cycle indicators (National Bureau of Economic Research)—show a parallel with business conditions in 1948. The leading series has already started its upturn as has the coincident series.

Much has been said of the inequities of allowable depreciation charges against capital equipment, stifling investments in production equipment and resulting in "tax enforced obsolescence." Now the new tax law (Internal Revenue Act of 1954) lessens these inequities and is at least a step in the right direction. In the past, business has been accustomed to restrictive and punitive legislation. Now the first measures of relief have been enacted. Thanks are due those who worked diligently to assist Congress in formulating this legislation. Of major interest are the two new options in the law: one allows for writing off about two-thirds of the original cost in the first half of a machine's tax life and the other allows about three-fourths of the cost during the same time.

Comments on the potential effectiveness of this new legislation from three outstanding tool builders are published as "Readers' Viewpoints" in this issue (page 141) and include the opinions of Henry D. Sharpe, Jr., Ralph E. Cross and J. A. Bradner. They express the opinion that this is constructive legislation and look forward to the time when a plant can determine its own depreciation policy according to its needs.

With the advantages offered, however, another look at those deferred plans to improve capital equipment is in order. Having a brighter future and an increased market for products, the tool engineer can advantageously keep the ball rolling. The chips are down. Show your mettle!

John W Greve

EDITOR

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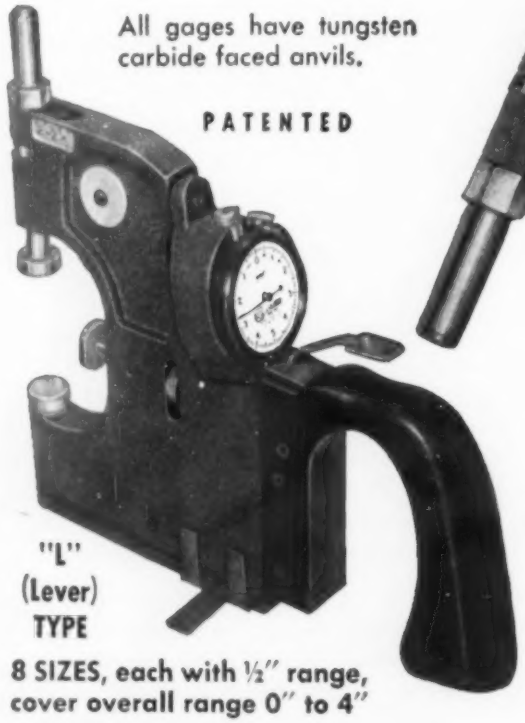
PARALLELISM PRESERVED

STANDARD'S new PARALLOC Dial Snap Gages introduce a new type of locking mechanism which maintains remarkably close parallelism between the anvil faces. Ordinary locking mechanisms tend to distort a portion of the frame in a way which swings the pin faces out of parallelism to a degree which is substantial in relation to close tolerances. In PARALLOC, the metal is merely squeezed *along the line of the pin axis*, leaving the parallel condition undisturbed throughout successive relockings of the anvil. *You can rely on parallelism with PARALLOC!*



All gages have tungsten carbide faced anvils.

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8 SIZES, each with ½" range, cover overall range 0" to 4"

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★ **PARALLELISM of anvils maintained, unaffected by tightness of clamping.**

★ **CHOICE OF INDICATORS . . . any AGD indicator in sizes 1 or 2, with desired dial graduations.**

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★ **ANVILS OVERHANG frame slightly to allow gage to be entered into narrow places and close to a shoulder.**

INDICATOR POSITION permits easy entry of gage into narrow recesses. Advantageously placed for observation.

FULLY ENCASED MOVEMENT AND INDICATOR protected against accidental damage.

CLIP-ON STAND holds gage firmly upright.

WRITE for new booklet, "NEWS", describing these and other new STANDARD developments.

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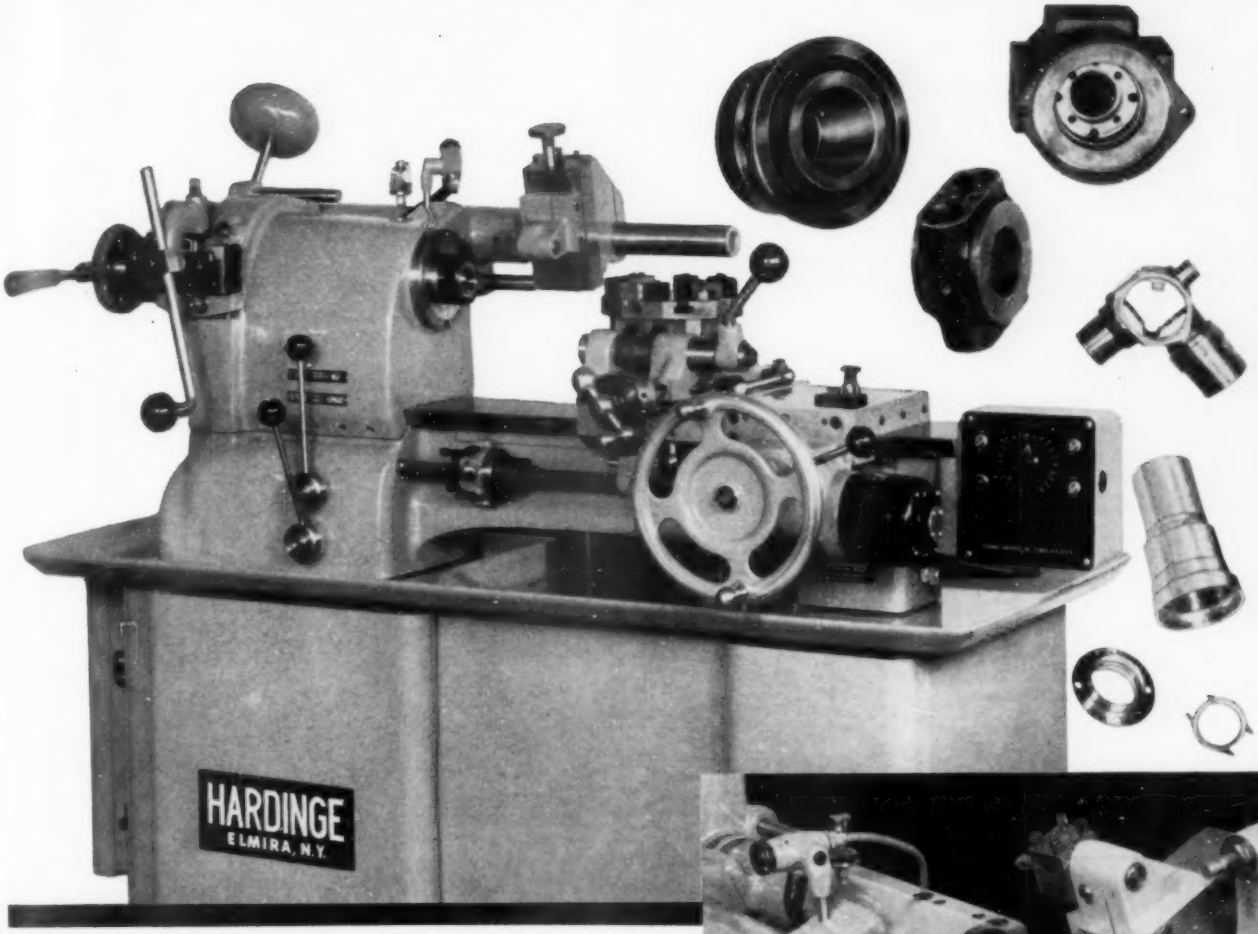
"We now get Production with Tool Room Accuracy"



Users enthusiastically tell us how they can easily maintain close tolerances, get better parts finish, and at the same time substantially cut costs . . . when they put Hardinge High Speed Precision Chucking Machines to work.

These results are possible because parts are finished in one setting with simplified tooling. All parts shown were produced with standard tool bits.

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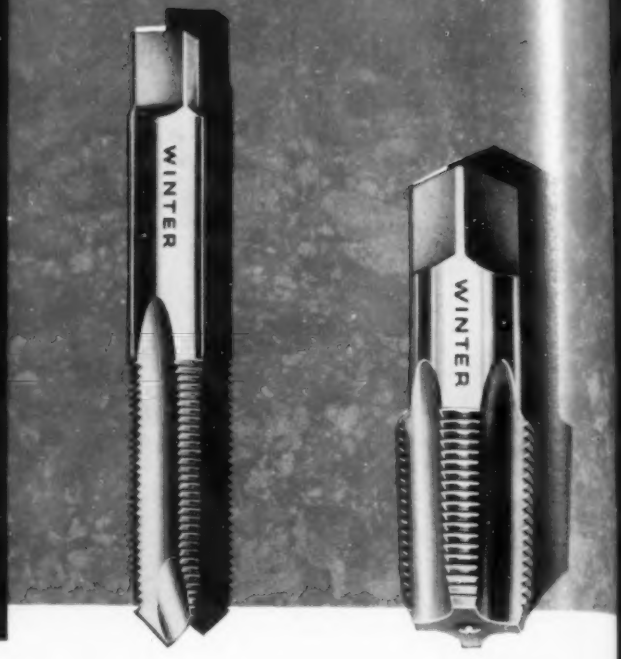
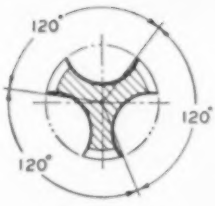
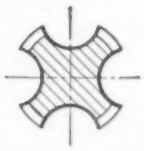
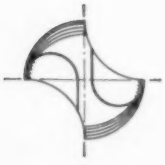




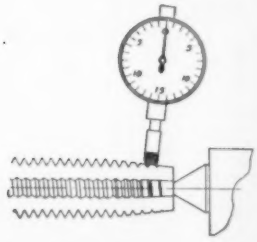
Exact Flute Spacing



Uniform Flute Contours



Precision Chip Driver Contours



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FOR SMOOTH, ACCURATE HOLES —AND LOTS OF THEM!

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Credit is due the "Ryan" engineers for developing such workable and time saving fixtures. Credit is also due the "Ryan" officials for selecting "AMERICAN" Hole Wizard Radials as part of the "winning combination."

"AMERICAN" Hole Wizards are sturdy; they are powerful; they are easy to operate and they retain their original accuracy for years to come. For substantiation just ask the operator.

Bulletin No. 315
will give you the facts.

THE AMERICAN TOOL WORKS CO.

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A "natural" for the ELECTRONICS Industry . . .

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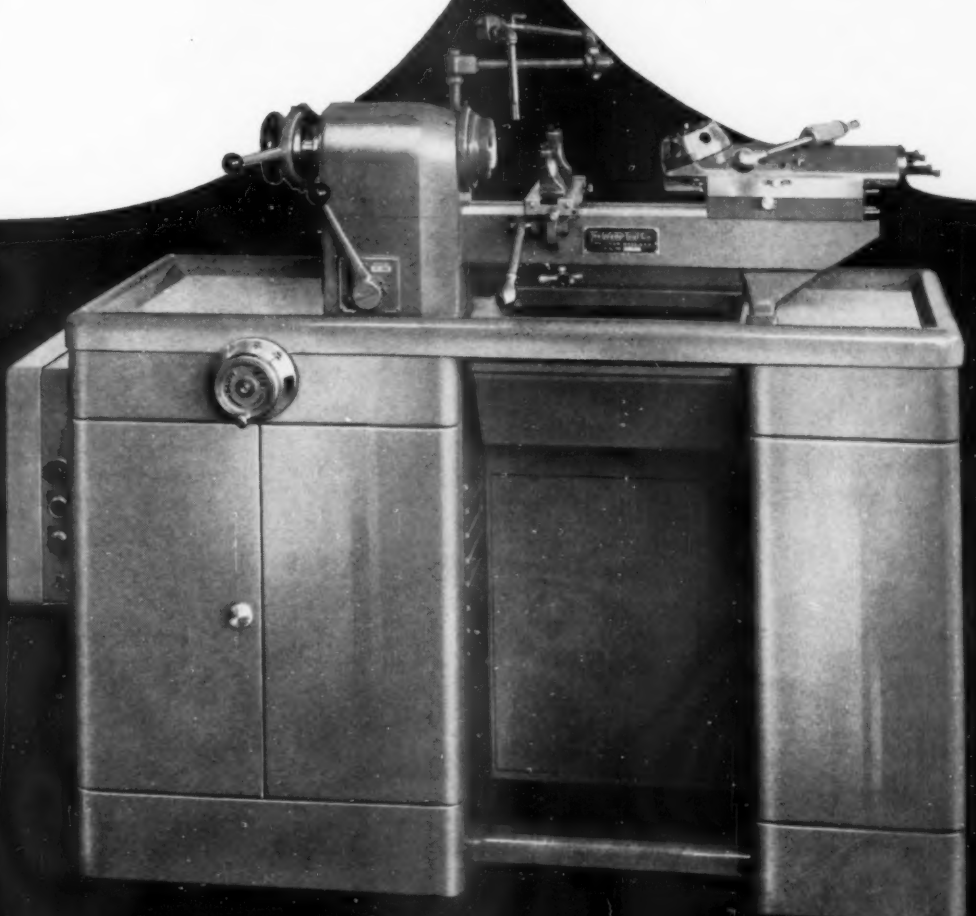
no. 73 HAND SCREW MACHINE

will increase your production and push down your shop costs



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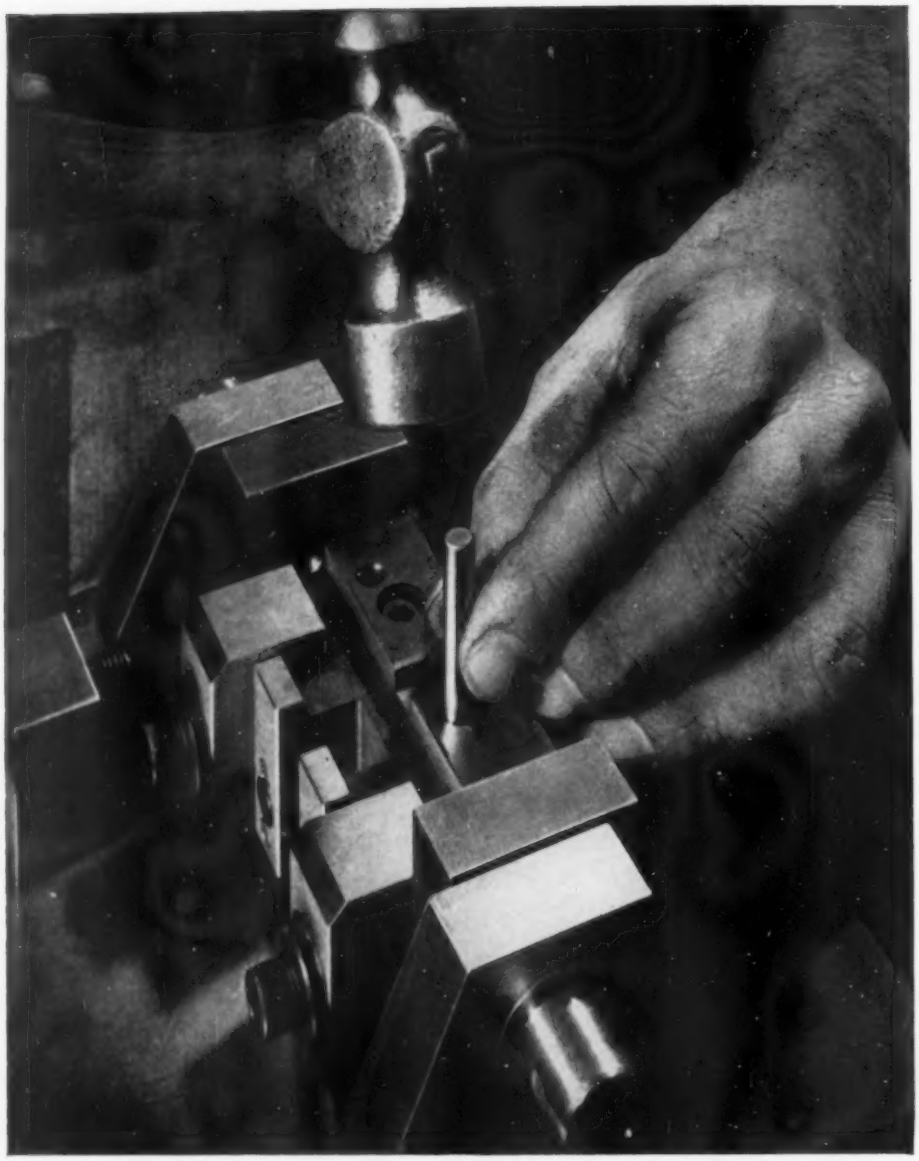
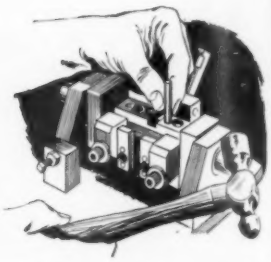


UNBRAKO Precision-Ground Dowel Pins are widely used for aligning parts, as in dies, jigs and fixtures. This radius grinding fixture, for putting a flat on electronic shafting, is a good example of such an application.

Assembler inserts formed end of UNBRAKO dowel pin into hole preparatory to tapping it into position.



Formed ends, with continuous grain flow, won't chip. Uniform heat treatment permits UNBRAKO dowel pins to be driven in and out of holes without upsetting.

UNBRAKO dowel pins—made of heat treated alloy steel—have a surface hardness of 60-62 Rockwell "C" Scale; a surface finish of 6 microinch maximum; a core hardness of 50-54 Rockwell "C" Scale; an average single shear strength of 150,000 psi; and a diameter tolerance of ±0.0001". They are available in two standard sizes in diameters from ⅛" to 1".

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Because your UNBRAKO distributor stocks a full line of standard UNBRAKO socket screw products, your inventory is lowered. This ready supply not only cuts your investment, but gives you faster delivery and reduces your buying costs. For a complete listing of standard UNBRAKO products, see your distributor or write STANDARD PRESSED STEEL CO., Jenkintown 37, Penna.

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

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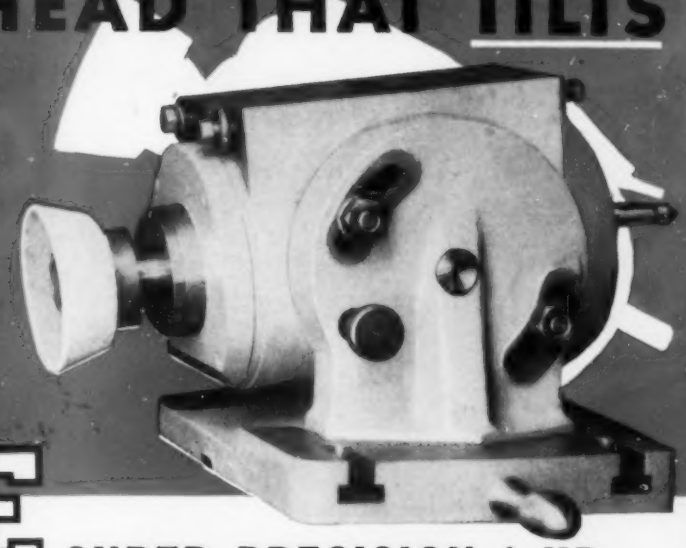
HERE'S A HEAD THAT TILTS

and Yours Will Nod, Too When You See What You Can Do With This One



POPE SUPER PRECISION 1 HP, 3600 RPM MOTORIZED TOOL AND CUTTER GRINDER CLEARANCE ANGLE SWIVELLING HEAD

With Angular Adjustment In A Vertical Plane

Give this versatile head the nod and save time and money these seven ways:

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2. You can keep the tooth rest on the center line of the cutter for practically all grinding on centers or in the work head.
3. You can grind most cutters and reamers all over *with a single set-up* using the swivelling table and Pope tilting head.
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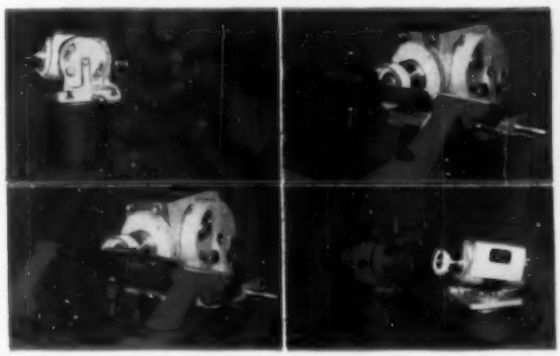
5. You can get the right clearance angle on such tough grinding jobs as slab mills, taper reamers, angular cutters and form tools.
6. You have one safe speed — 3600 RPM — for all wheels generally used on cutter grinders. Heat checking of cutters is virtually eliminated.
7. You have a head that's so easy to adjust and use it saves you time and money every time you grind a tool.



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261 RIVER STREET · HAVERHILL, MASSACHUSETTS

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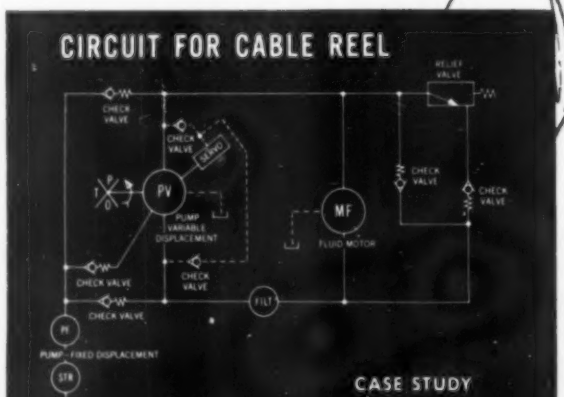

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● Quick starts, quick stops, stalling under load, continuous braking. These are the kind of conditions Denison Fluid Motors are built for. Where other motors fail, Denison hydraulic motors operate continuously . . . in conveying equipment, mining, drilling, construction machinery.

Through efficient axial piston design, Denison hydraulic motors pack high horsepower, high torque in a smaller space. The 400 series fluid motor is less than a foot long, weighs only 40 pounds . . . yet delivers 24 horsepower.

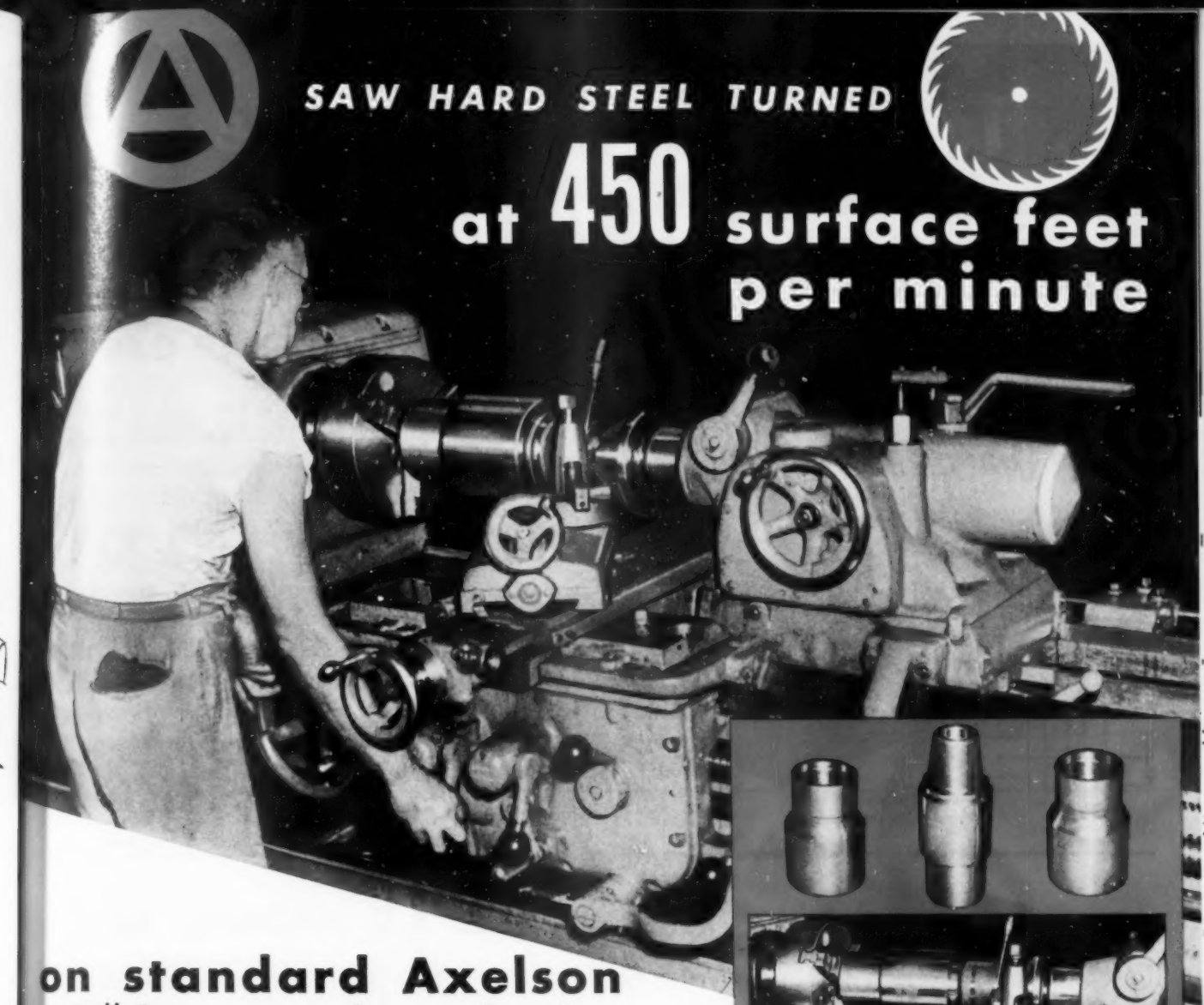
Denison Fluid Motors can be furnished to develop up to 180 horsepower, 5665 pounds-inches torque . . . for any hydraulic circuit to 5000 psi.

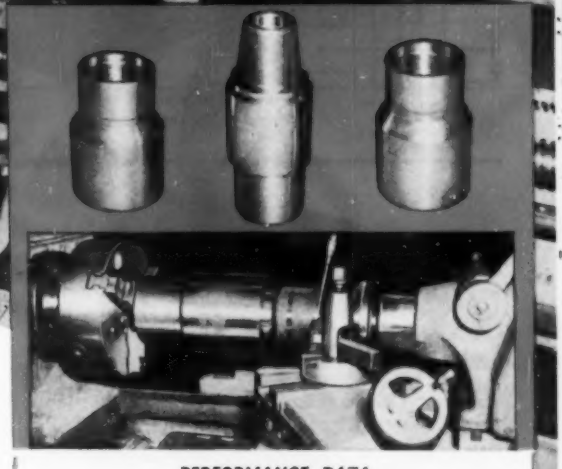
The circuit shows a Denison Fluid Motor that reels cable in and out of oil wells. For bulletins about Denison Fluid Motors, write to: THE DENISON ENGINEERING COMPANY, 1191 Dublin Road, Columbus 16, Ohio.

PUMPS • MOTORS
CONTROLS • PRESSES

DENISON TRADE MARK *HydrOILics*

SAW HARD STEEL TURNED at 450 surface feet per minute





on standard Axelson 20" heavy duty lathe

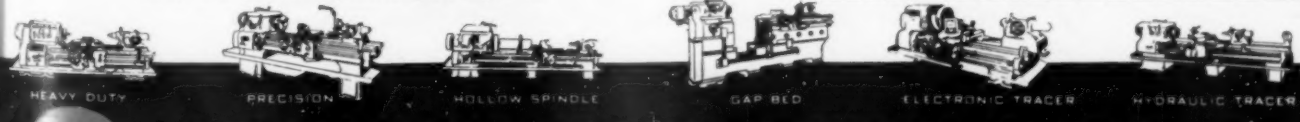
Heat treated steel forged oil tools that test 38 Rockwell C are precision turned at 450 surface feet per minute on this standard Axelson 20" heavy duty lathe. Both one-quarter inch roughing cuts and fine finishing cuts are made at this speed using Vascaloy E cutting tools and chemical coolant. The cutting tools have chip breakers ground into them and cutting edges are honed to produce better finishes and longer tool life. All turned surfaces including threads are machined to better than 40 micro inch finishes, which eliminates costly grinding operations. Tolerances of — ±.0015" are easily held.

Axelson lathes are precision built and designed to take full advantage of **high speed** cost cutting turning techniques. Standard Axelson 20" lathes now have top spindle speeds of 1288 R.P.M. Spindles are mounted on double front and rear precision timken bearings and are driven through a series of hardened and precision ground alloy steel gears that maintain a smooth flow of power to the cutting tool. Flame hardened and precision ground tool steel carriage ways preserve original accuracy and alignment year after year. These standard Axelson features provide the essential requirements for modern high speed turning. Axelson Engineering will be glad to make suggestions for your work—whatever your problem may be —without obligation.

Call on the Axelson dealer or representative in your locality or write direct to the factory at 6146 S. Boyle Avenue, Los Angeles 58, Calif.

PERFORMANCE DATA

Company	Directo Corp., Houston, Texas.
Part	Drill Collar Sub—"Fluidrill" Part
Machine	Axelson 20" Heavy Duty Lathe
Number of Pieces	10 per Lot
Material	S.A.E. 4340 Heat treated
Hardness	38 Rockwell C
Depth of Cut	¼ Roughing
Greatest Precision	±.0015"
Tool Material	Vascaloy E—with special chip breaker .010" deep, .060" wide, .030" radius, cutting edge honed.
Coolant	Chemical coolant 25-1
Feed	.012" Rough, .008" Finish
Speed	287 RPM—450 S.F.M.
Floor to Floor Time	4½ hours complete
Finish	Better than 40 micro inches
Note	Threads were cut by feeding straight-in at 250 S.F.M.
Product	The Fluidrill is a revolutionary aid that will increase the speed of penetration in rotary oil well drilling of more than 25" by keeping the bit firmly seated on bottom and cutting at all times.



AXELSON MANUFACTURING COMPANY DIVISION

PRESSED STEEL CAR COMPANY, INC.

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PSC

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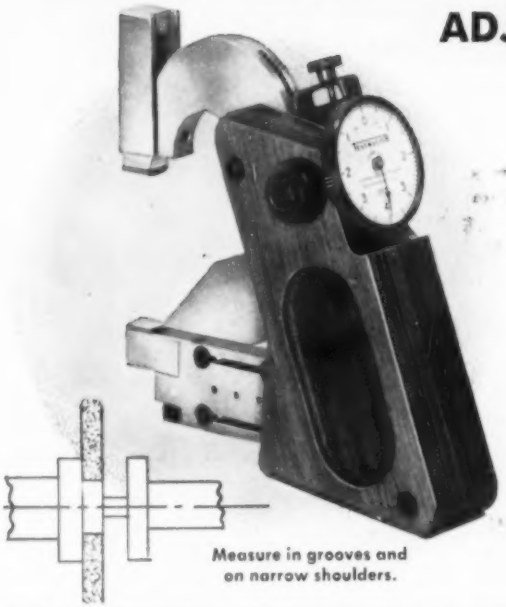
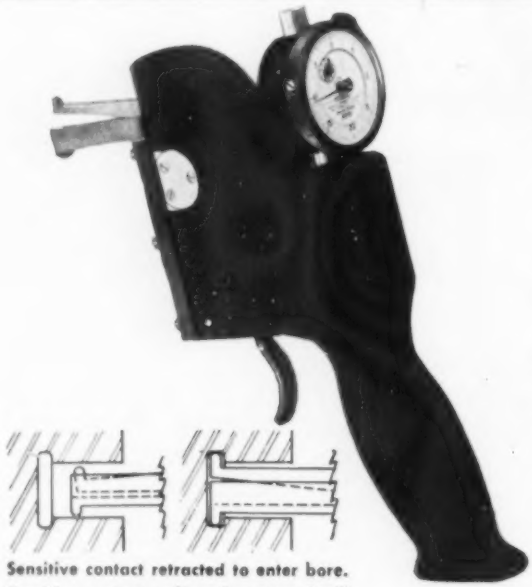
Two NEW gages get measurements IN THE GROOVE!



Measure in grooves and on narrow shoulders.

ADJUSTABLE INDICATING SNAP GAGES 1340 TYPE

THESE ADJUSTABLE SNAP GAGES show *actual* dimensional variations of .0001" because the gage rests on the "solid" upper anvil and the reading is not influenced by the weight of gage nor by the user's hand. The anvils are offset at front of gage and the upper anvil is readily adjustable. When it's locked at the desired position, minor adjustments are made by adjusting the Indicator Dial. The thin anvils and arms of these gages are particularly useful for measuring in grooves, slots, or between close shoulders. Inexpensive, adaptable and totally dependable, these new gages have a thousand uses in all shops — whether small or large.



Sensitive contact retracted to enter bore.
Sensitive contact, released, centers itself at maximum diameter of groove.

ADJUSTABLE I. D. GROOVE GAGE

THIS NEW GAGE IS ADJUSTABLE TO MEASURE the diameter of a wide range of internal grooves as used for sealing or retaining rings. Adjustable to measure grooves between .725" and 2.625" diameter, it enters bores with diameters down to .500". Contacts at the ends of the arms check grooves even at the bottom of blind holes. Because the fixed contact is on lower arm, neither the weight of the gage nor pressure from the operator's hand affects the reading. For the whole story on these NEW gages, write:

FEDERAL PRODUCTS CORPORATION
41910 EDDY ST., PROVIDENCE 1, R. I.

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES...

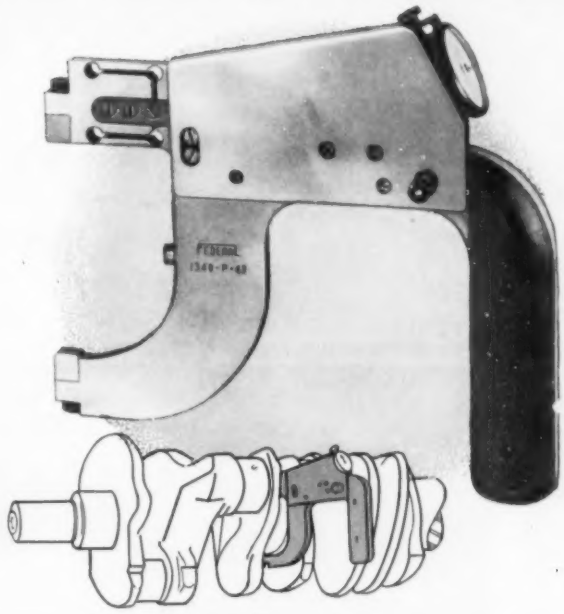
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automatically Controlling Dimensions on Machines

TWO NEW GAGES

TRY 'EM FOR *SIZE* ON TOUGH MEASURING JOBS!

INDICATING CRANKSHAFT GAGE MODEL 1340 P-40

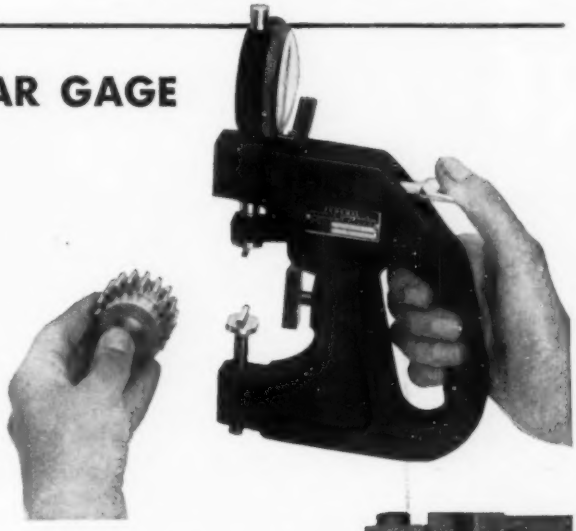
BUILT ESPECIALLY FOR CRANKSHAFT JOBS and similar work, this thin gage gets in between shoulders or close beside bearings and its flat anvils of Tungsten Carbide permit accurate measurements of such critical dimensions. Measurements are transferred from the sensitive anvil to the CONVENIENTLY PLACED INDICATOR through the integrated pantograph unit. Free of all friction, inertia and side play, this unit also counteracts the weight of the gage and operator's hand.



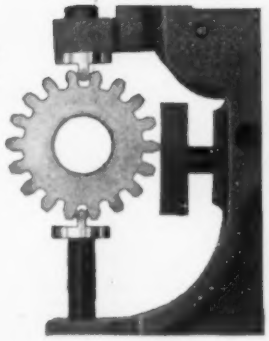
No matter what the position of the throws, Model 1340 P-40 easily measures bearing diameters in the narrow spaces between shoulders of a crankshaft.

PITCH DIAMETER AND SPIRAL GEAR GAGE 202 SERIES

FOR USE IN STATISTICAL QUALITY CONTROL right at the machine as well as final inspection, these gages check pitch diameter of spur gears, helical gears, splines, and chain sprockets. Both upper and lower contacts are of Tungsten Carbide. The upper contact is adjustable for 1" on all five regular sizes and swivels so it seats properly in relation to the lower anvil before being locked in position. The adjustable rear guide positions the gage on the gear, assuring gaging the proper spaces between gear teeth which may be either even or odd in number. For complete information on these new tools, write today to:



Gear centered properly by rear guide and cylindrical contacts.



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Norgren Spray-Lube System

ON RADIAL DRILL TAPPING HOLES IN 1⅛" ALLOY STEEL

at O. K. RUBBER, INC.

- more than doubled tap life
- increased tap speed 38%
- improved quality of tapped hole
- eliminated the "mess" and excessive coolant cost of flood method

and

- *paid for itself in one month in machine cleaning time alone*

WRITE FOR DETAILS IN NORGREN BLUEPRINT SL-3

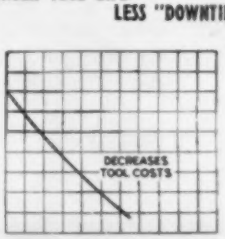
NORGREN SPRAY-LUBE SYSTEM

An Automatic, Air-Powered System for More Efficient Single or Multi-Point Application of Cutting Liquids to Metal Cutting and Forming Operations! For Tapping Machines, Drill Presses, Lathes, Milling Machines, Grinders, Stamping Presses, Boring Mills, Deep Draw Presses and Other Metal Working Machines.

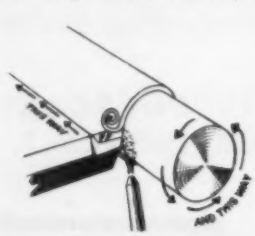
NEW ADVANTAGES THAT ARE PRODUCING SPECTACULAR RESULTS ON PRODUCTION LINES

COOLANT WHERE YOU NEED IT COOLS FASTER

LONGER TOOL LIFE — LESS "DOWNTIME"



FASTER CUTTING SPEEDS AND FEEDS



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PIONEER AND LEADER IN OIL-FOG LUBRICATION FOR 26 YEARS

VALVES • FILTERS • HOSE ASSEMBLIES • REGULATORS • LUBRICATORS

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

SAVING TIME ON 6 TYPES—AND 24 SIZES

No. 24 Hydraulic Automatic Lathe with Hydraulic Tracer Unit Speeds Output of Bearing Races

Put new zip and lower costs into bearing race production with *six* different types and *24* varying sizes? And do the whole job on only *one* machine? Sounds like quite an order, doesn't it?

It's really a pushover with the No. 24 Hydraulic Automatic Lathe—equipped with the Gisholt Hydraulic Tracer Unit. This user shows how inner and outer bearing races requiring spherical, straight or tapered bores can be handled with speed and ease.

In the first operation, longitudinal movement of the front carriage and transverse movement of the standard slide permit tools to turn the O.D. up to the chuck jaws and face the forgings. The longitudinal movement of the rear carriage carries the tooling toward the spindle, and the template-controlled Hydraulic Tracer Unit actuates the rear slide, causing tools to rough-generate the spherical bore (for this typical 18" O.D. part) and break the corners at the end of the cut.

Tracer Unit Holds Fine Tolerances

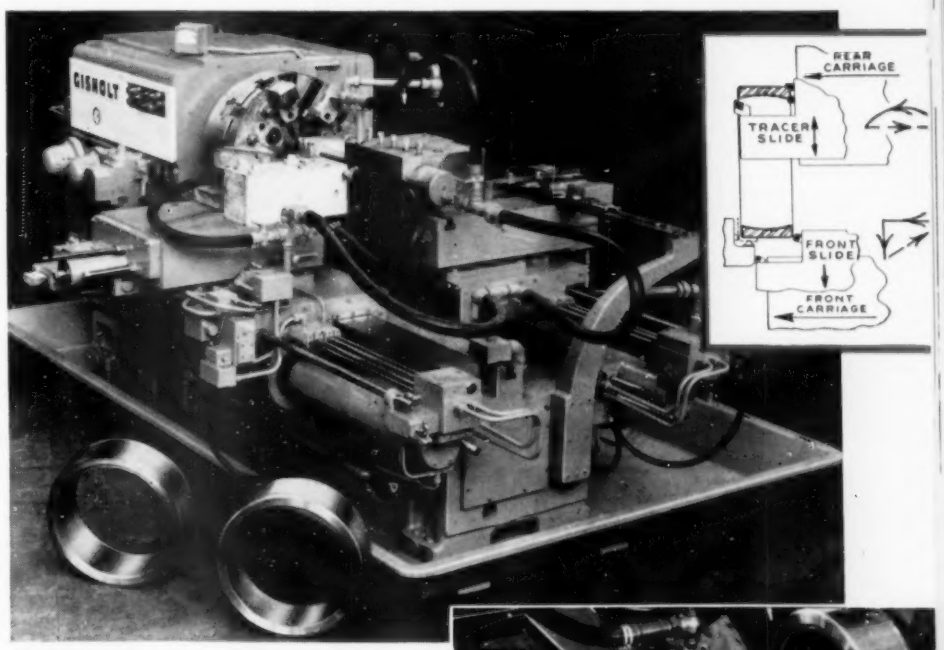
For the second operation the template is quickly re-located and the stops changed. Tools on the front slide finish turn the O.D. and face the other side. Tools on the tracer-controlled rear slide finish-generate the spherical bore, holding a .0005" tolerance, and then break the corners.

Each operation takes just 8 minutes f.t.f. with 90 lb. of tough bearing steel removed in less than 16 minutes total machining time. That's really knocking 'em out!

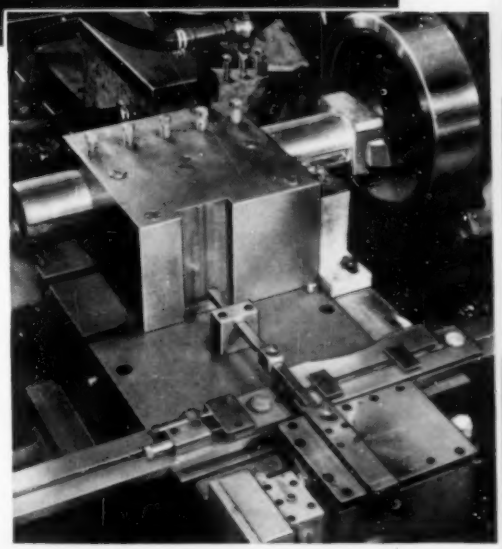
The Gisholt Hydraulic Tracer Unit operates at high pressure with slide movements controlled by a template and stylus-type follower. Square faces can be machined and cuts of ¾" depth at .035" feed are easily made. Setup is quick with convenient micrometer adjustment screws for accurate slide and template positioning.

The Hydraulic Tracer Unit is adaptable to other machines, too, for solving a wide variety of production problems. Your Gisholt representative can tell you about it and the No. 24 Hydraulic Automatic Lathe.

Quick changes for doing spherical, straight and tapered boring in a multitude of parts have one simple solution . . . the Gisholt Hydraulic Tracer Unit.



No. 24 Hydraulic Automatic Lathe set up for bearing race production.



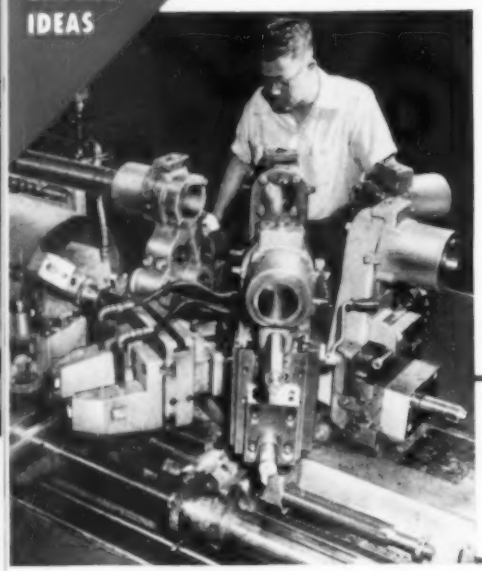
The hydraulic tracer controlled rear slide arrangement. Note the micrometer settings for positioning the template.

GISHOLT

TIME-SAVING IDEAS

HERE'S SOME TICKLISH INTERNAL BORING AND FORMING—*Done With Standard Slide Tools*

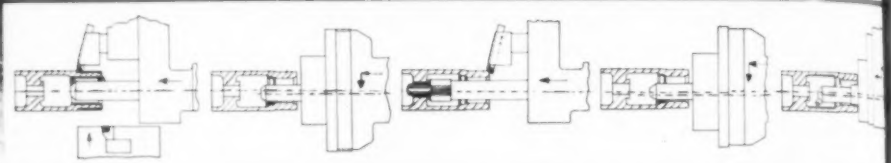
How the Gisholt Fastermatic Automatic Turret Lathe Reduces Time and Costs



The producers of these parts had the problem of going through an outer small diameter bore in order to get to a larger diameter bore inside. Ticklish as it sounds, they came up with "stock" tool answers to keep costs down.

The job's being done on a Gisholt 2F Fastermatic Automatic Turret Lathe with slide tools mounted on hexagon turret stations and operated by the standard back-facing attachment on the rear cross slide. After the tools have reached required depth through the small bore, the back-facing attachment actuates the slide which carries the tool the short distance necessary to complete internal machining operations. The workpieces—which are malleable iron valve castings—are machined in a floor-to-floor time of 4.2 minutes.

Here standard tools working in close quarters cut costs with internal boring and forming of castings completed in one fast, automatic cycle.



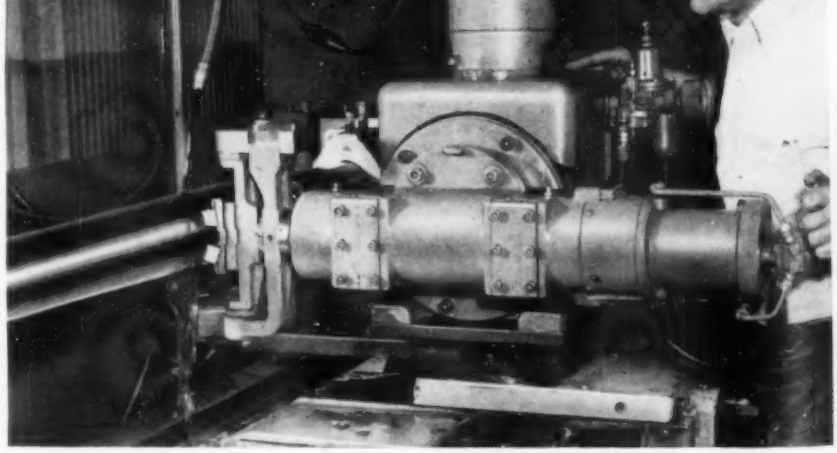
SAVES UP TO 3½ HOURS PER PART...INSURES BETTER CHROME PLATING BY SWITCH TO SUPERFINISH

Inexpensive Attachment for Turret Lathe

Long life and fine operation make it necessary that these forged steel piston rods for hydraulic presses be chrome plated. Production was slow and costly—penalized by a polishing operation which required four hours to complete.

A dramatic answer to this time problem was provided by Superfinishing. Now, the piston rods are turned on this Gisholt 3L Saddle Type Turret Lathe and Superfinished via an inexpensive attachment—right on the lathe. There is no polishing operation this way; only 30 minutes are needed to Superfinish. The saving in time: 3½ hours!

Not only is the geometry of the piston rod improved by Superfinishing, but the surface is also brought down to true base metal which permits excellent, hard chrome plating. In this case, the turned surface of approximately 150 micro-inches R.M.S. is refined to a 5 to 7 micro-inch surface finish.



Surface finish on the piston rod is improved by Superfinishing over the former polishing method.

This simple attachment on a Gisholt Turret Lathe reduced a four-hour polishing operation to a thirty-minute Superfinishing job. Costs are lower, results much better.

The new SUPERFINISHING CATALOG tells about this important process, shows many interesting jobs. Write for yours.

MA E MORE MONEY FOR YOU

GISHOLT

TIME-SAVING IDEAS

NOTHING LIKE THE CROSS-FEEDING HEXAGON TURRET FOR JOBS LIKE THIS

Heavy Parts Simultaneously Machined at Both Ends

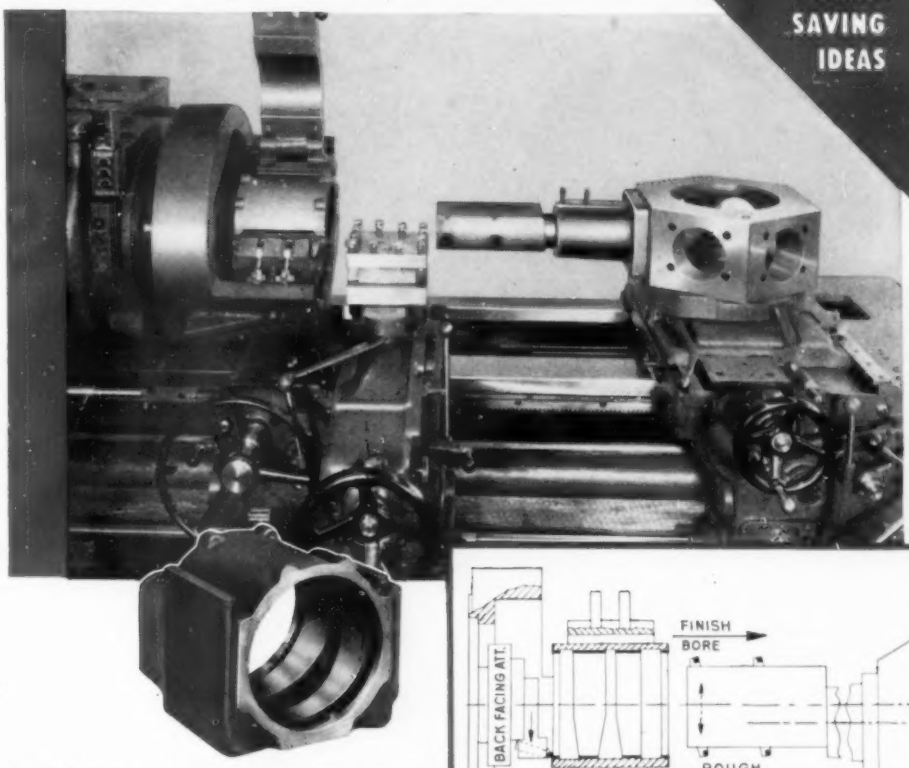
Not every lathe can make such a simple job of work like this: rough and finish boring . . . while simultaneously facing both ends of a part.

This Gisholt 4L Saddle Type Turret Lathe is doing it to these railroad bearing journal boxes. The cast steel workpieces are loaded by crane in the fixture.

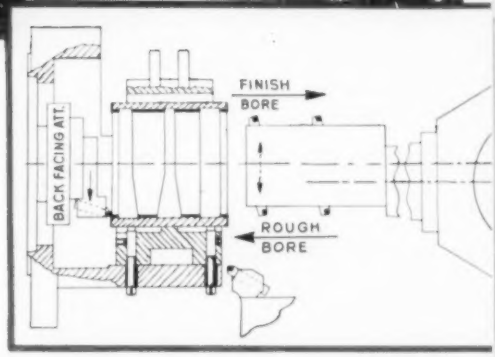
The cross-feeding hexagon turret carriage is equipped with solid positive stops on the front and rear which take care of sizing the bore for both the forward feed and reverse feed machining operations. Two tools are on both the front and back of the boring head, thus splitting up the cut.

For rough boring, the hexagon turret is brought forward to the front stop and then fed into the work. When boring is completed, the hexagon turret is moved back to the rear dead stop and fed outward for finish boring. A back facing attachment within the spindle faces one end, and the square turret tool faces the other end.

This unique tooling setup is used for machining 9 different sizes of workpieces with f.t.f. time ranging from 23 to 31 minutes.



When fixture is closed and machine starts, cross-feeding hexagon turret tools you see do rough boring. Tools on other side do finish bore on reverse feed.



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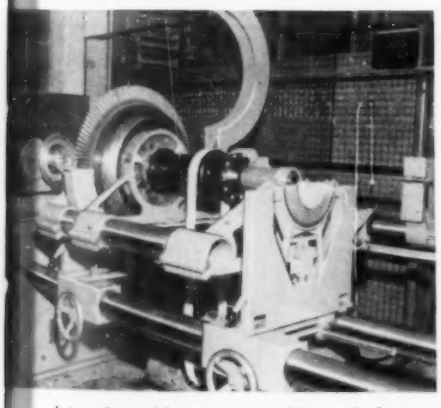
A SIMPLE SOLUTION TO SPECIAL BALANCING PROBLEM

Gisholt Balancing Machine Locates Dangerous Unbalance in Jet Engine Part



Jet engine turbine rotor assembly ready for precision balancing. Shroud is lowered over rotor during balancing operation.

Gisholt Balancing School—offers complete courses in theory and practical application of balancing to help with your particular problems. For complete details, starting dates, write today.

Unbalance causes vibration, and vibration means trouble. Bad trouble in the case of this jet engine turbine rotor assembly if it were allowed to remain. That's why precision balancing is such an important part of production.

A Gisholt DYNETRIC 3UJP Balancing Machine is used for dynamically balancing every assembly. Placed in a special cradle, the unit is rotated on its own bearings. Shrouding is provided to reduce air load.

Taking direct readings from the machine, the operator quickly corrects unbalance by adding steel weights in a balance-ring groove machined on the outside face of the turbine wheel for the left correction plane—and by adding washers to bolts for the right correction plane. The result is balance of unbelievably low tolerances, completely smooth operation.

Precision balancing can make your rotating parts and products better performing . . . and more lasting. Gisholt balancing equipment is adaptable for virtually every balancing problem.

Providing balancing correction facilities in the original design speeds up this vital balancing operation.

DYNETRIC BALANCERS — GISHOLT — DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION. "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

There is full information in the booklet, GISHOLT BALANCING MACHINES. Ask your Gisholt representative, or write direct for your copy.

GISHOLT

TALK TO GISHOLT ABOUT MACHINE TOOL LEASING

GISHOLT

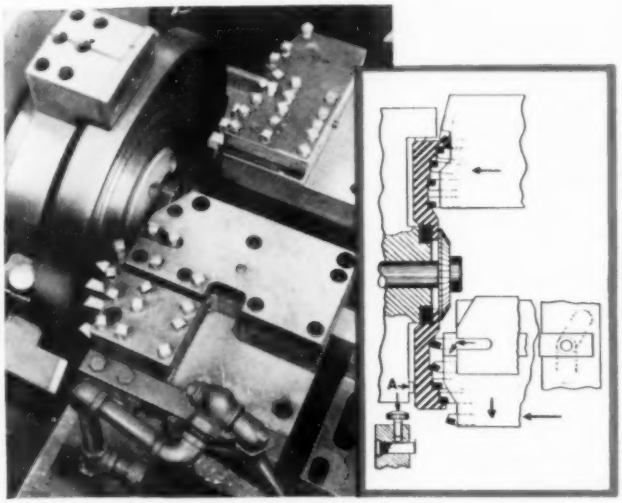
TIME-SAVING IDEAS

BUNCHING UP OF CUTS FINISHES LARGE PARTS FAST

Simplimatic Pulls 11 Tools at Once to Cut Costs!

These large steel flywheels require boring and facing on several diameters—plus special angle facing. The best approach to the problem was found in the Gisholt Simplimatic Automatic Lathe. This permitted combining all operations in one setup.

The 19" flywheel is held by an air-operated drawback fixture. The job starts with tools on the front slide being table fed to cutting position. Normal slide movement then carries the tools away from the spindle centerline, finish facing three step faces and the rim face. The hub angle is finish faced with a tool held in a sliding tool holder mounted inside the main tool block and controlled by a special cam. Tools on the rear slide finish bore three co-bores, finish turn the hub and chamfer the rim O.D. and I.D. A total of eleven tools works simultaneously to finish this part in just 5.60 minutes f.t.f.



Tooling setup for machining flywheels. "A" shows spring jack for supporting edges of workpiece and preventing chance of distortion.

Close-up shows tooling arrangement on front and rear slides and sliding tool holder mounted inside the main tool block.

Straight and angular facing, plunging and facing, turning, boring and chamfering . . . all these cuts are taken simultaneously on the Simplimatic Automatic Lathe with speed that means minimum costs.

• • •

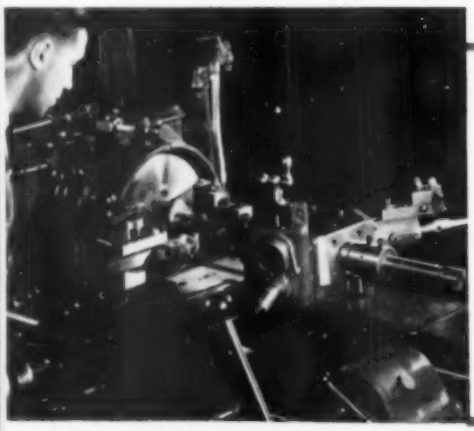
CHUCKING RING SAVES SECOND OPERATION

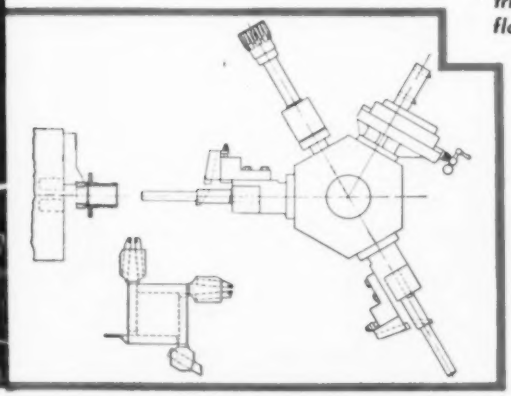
Gisholt Ram Type Turret Lathe Speeds Turning and Boring Work

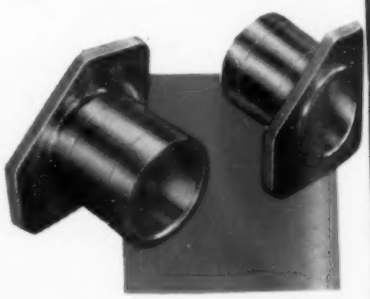
Machining these bearing support bushings would normally be a two-operation job. But it isn't, because of the addition of a chucking ring to the casting. It's a case of the slight value of the cut-off stock being more than made up by savings in time and greater accuracy.

Tools on the hexagon turret bore, turn, face, ream and chamfer. At the same time, tools mounted in special double tool holders on the square turret rough and finish straddle-face the flange, form the O.D. relief and cut off to length. Time is only 3.5 minutes f.t.f.

By leaving a chucking ring on the workpiece, a second operation is eliminated, concentricity is assured as is parallel facing of flange. Saves machining time, too.







No. 9-1054
629

GISHOLT

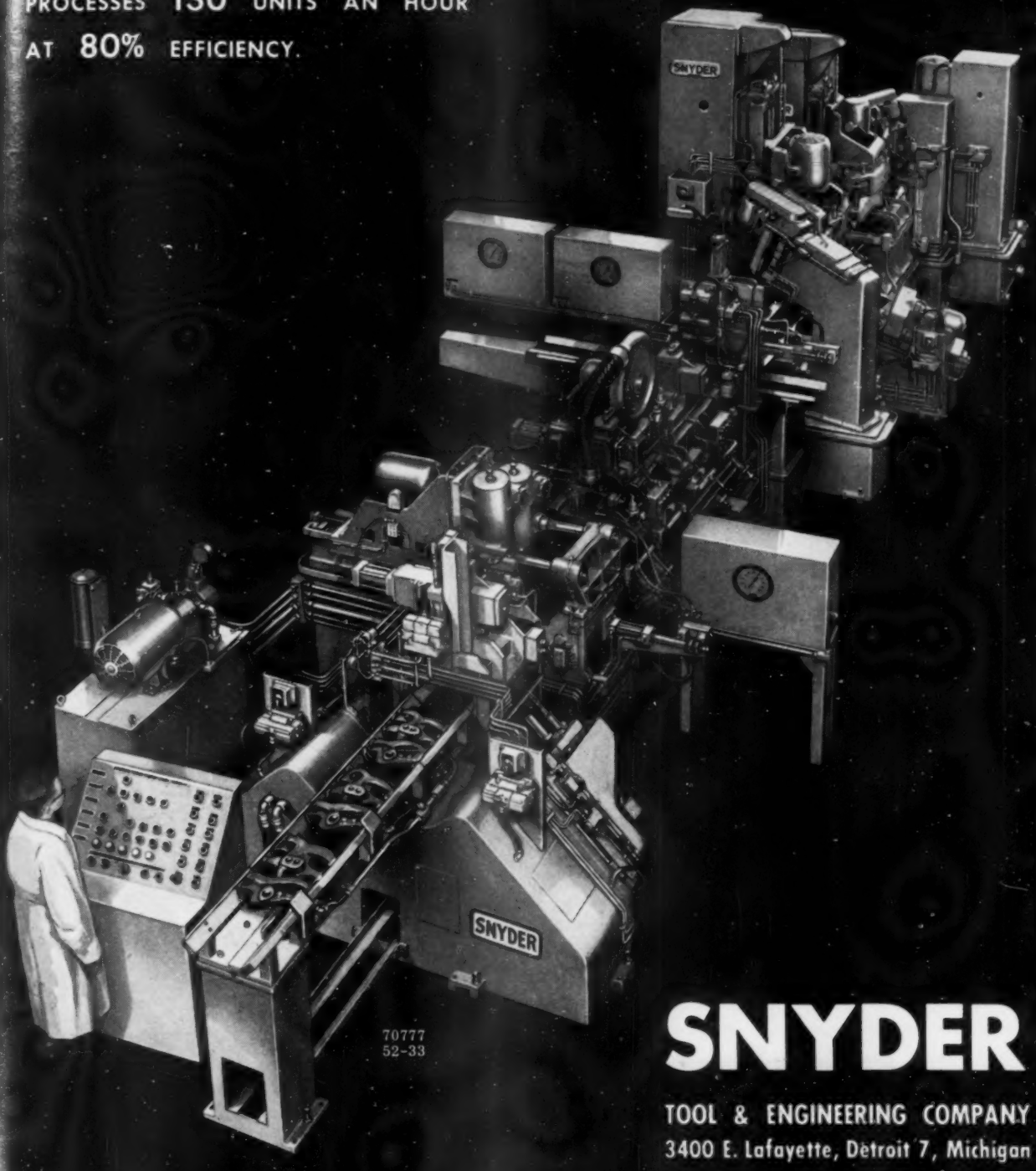
THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

SNYDER SPECIAL 21-STATION AUTOMATIC LINE

TRANSFER MILLS, DRILLS, CORE-DRILLS, REAMS AND TAPS INTAKE MANIFOLDS; TESTS MANIFOLD FOR AIR LEAKAGE AND VOLUMETRIC AIR FLOW, INSPECTS PROCESSING PROGRESSIVELY, MARKS REJECTS; INSERTS HEATER TUBES; PROCESSES 130 UNITS AN HOUR AT 80% EFFICIENCY.



SNYDER

TOOL & ENGINEERING COMPANY

3400 E. Lafayette, Detroit 7, Michigan

29 Years of Successful Cooperation with Leading American Industries

A Demonstration of the LANDIS Thread Rolling Machine on your workpieces

The new LAN-HY-ROL Thread Rolling Machine offers a combination of precision, productivity, and flexibility in generating external threads unequalled by any other machine now available in the Western Hemisphere. Yet we believe that its superiority is so great that its unlimited potentialities cannot be understood without seeing actual operation.

Therefore, we are offering all manufacturers an operating demonstration of the new LAN-HY-ROL, using your own workpieces if you prefer. Send us the necessary thread specifications and prepared workblanks—we will make the dies required at our own expense, then arrange an operating demonstration here in Waynesboro at your convenience.

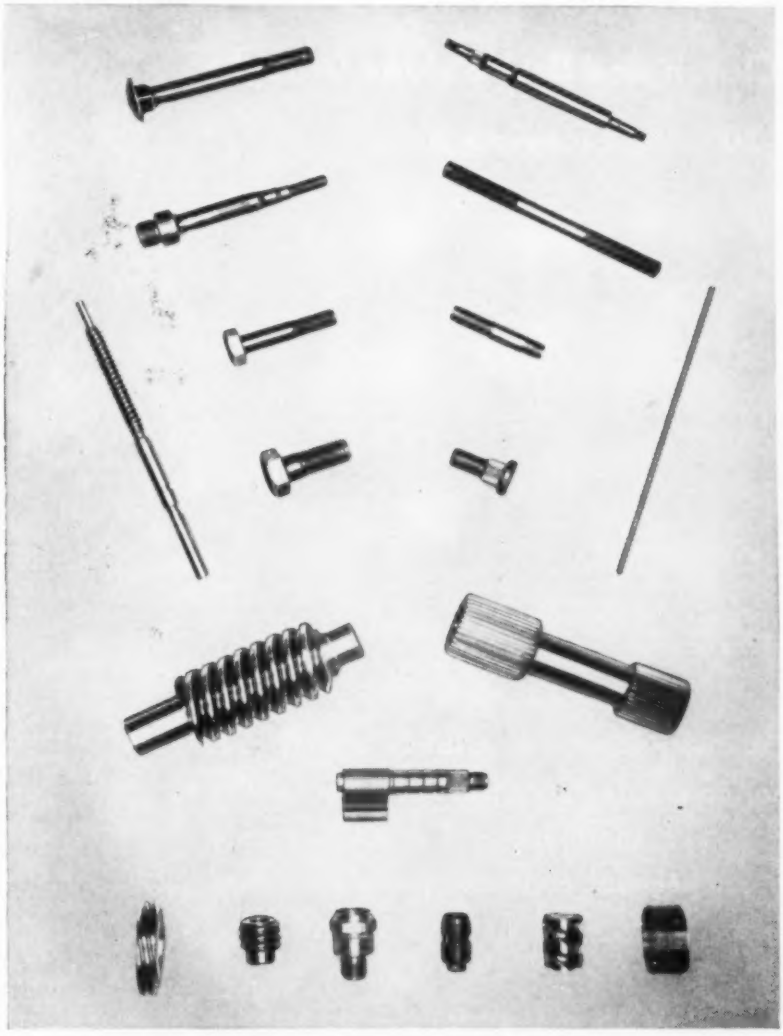
The new LAN-HY-ROL is based on a rolling system using two circular thread rolling dies and a work support blade. It will produce UNC and UNF threads to tolerances up to and including Class 4, and will also roll Acme, worm, and other special threads. The LAN-HY-ROL will roll threads from 3/16″ to 3″ in diameter up to 5-7/8″ long by plunge rolling, and up to 72″ by thrufeed rolling. It can also be equipped for automatic hopper feeding, semi-automatic hand feeding, or rolling special threads between centers.

Plan today to investigate the cost-saving advantages of the new LAN-HY-ROL Thread Rolling Machine. Contact us direct in Waynesboro, or through one of our field representatives, about arranging a demonstration.

408-C

LAN-HY-ROL

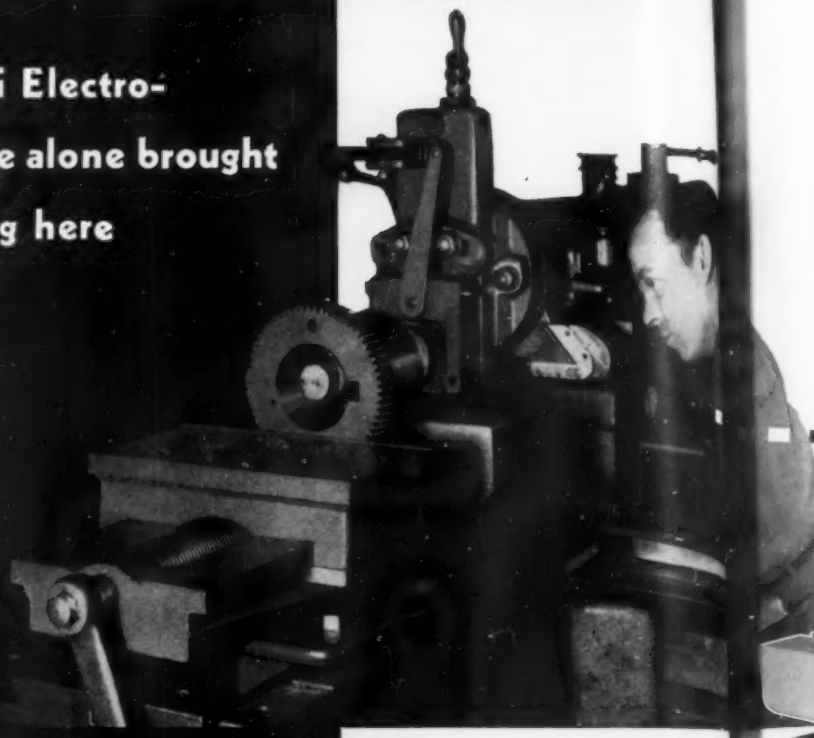
MANUFACTURERS OF THREADING EQUIPMENT—CUTTING—TAPPING—GRINDING—ROLLING



LANDIS *Machine* CO. WAYNESBORO PENNSYLVANIA

Outstanding Time Saver...

The New Cincinnati Electro-Magnetic Clutch and Brake alone brought a 30% time-saving here



The New Cincinnati Magnetic Clutch and Brake, with its single, convenient control lever, gives the operator the fastest, simplest and most accurate control of his Shaper and converts waste time into productive time.

This powerful clutch and brake requires no adjustment, and has a long, maintenance-free life.

Write for Cincinnati Shaper Catalog N-6.

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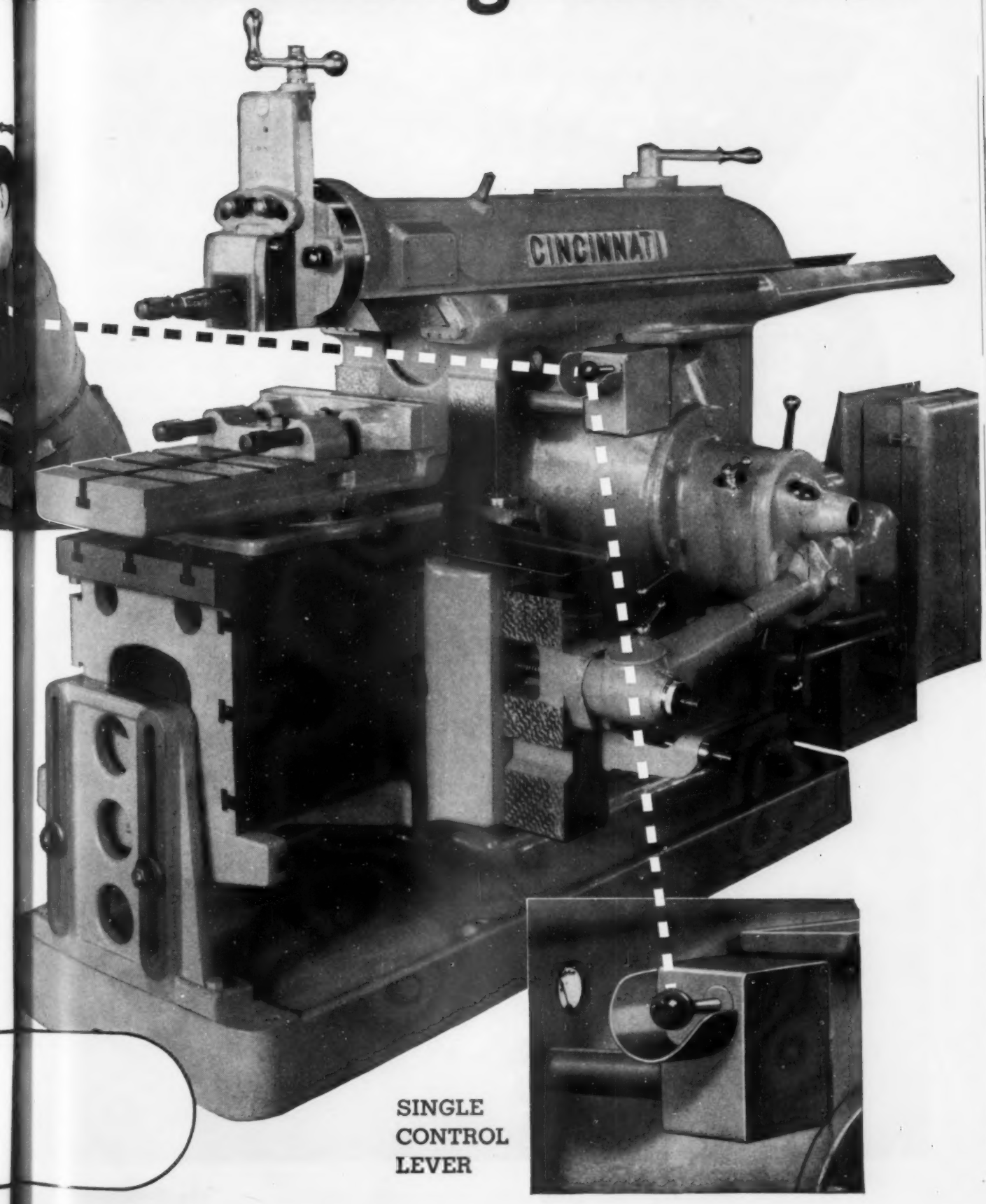

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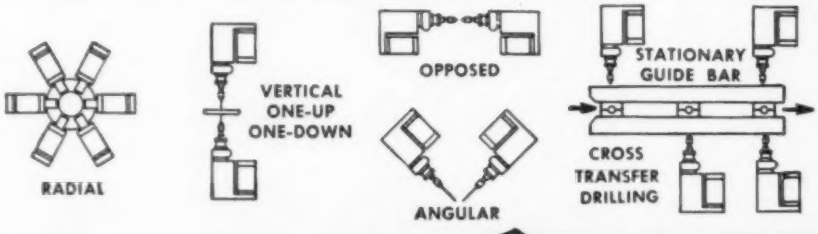

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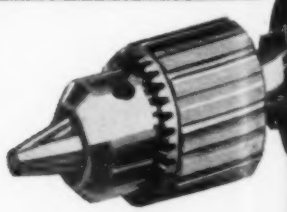

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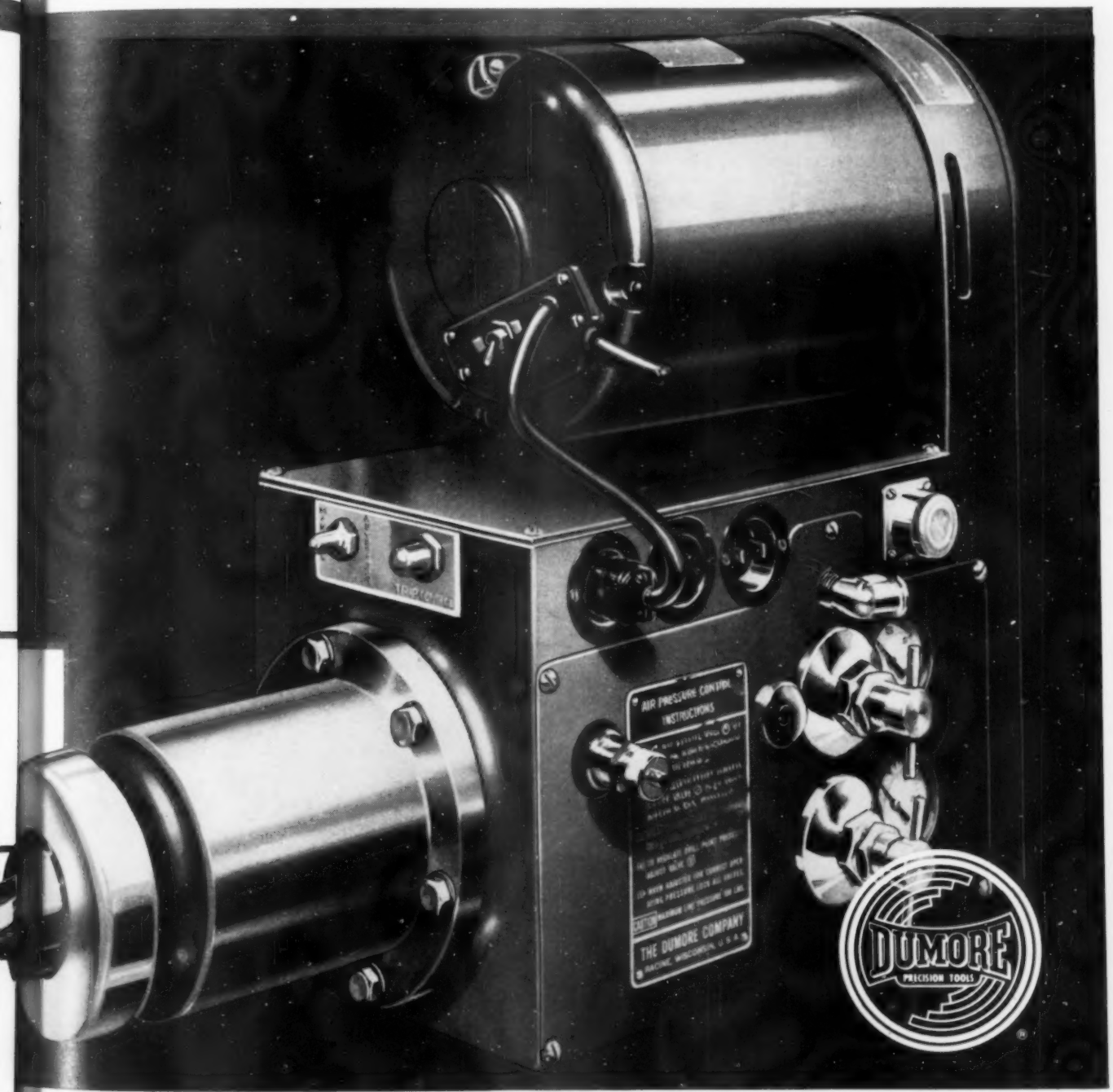

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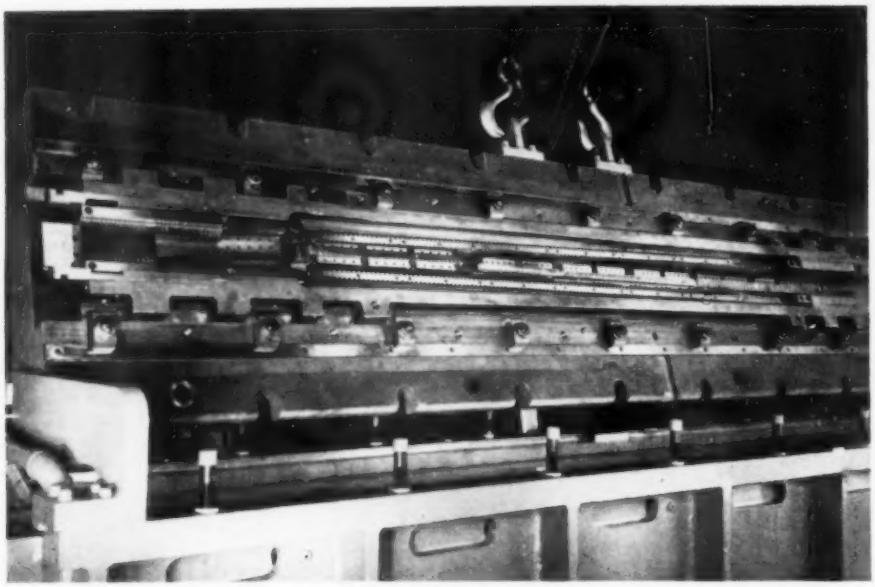

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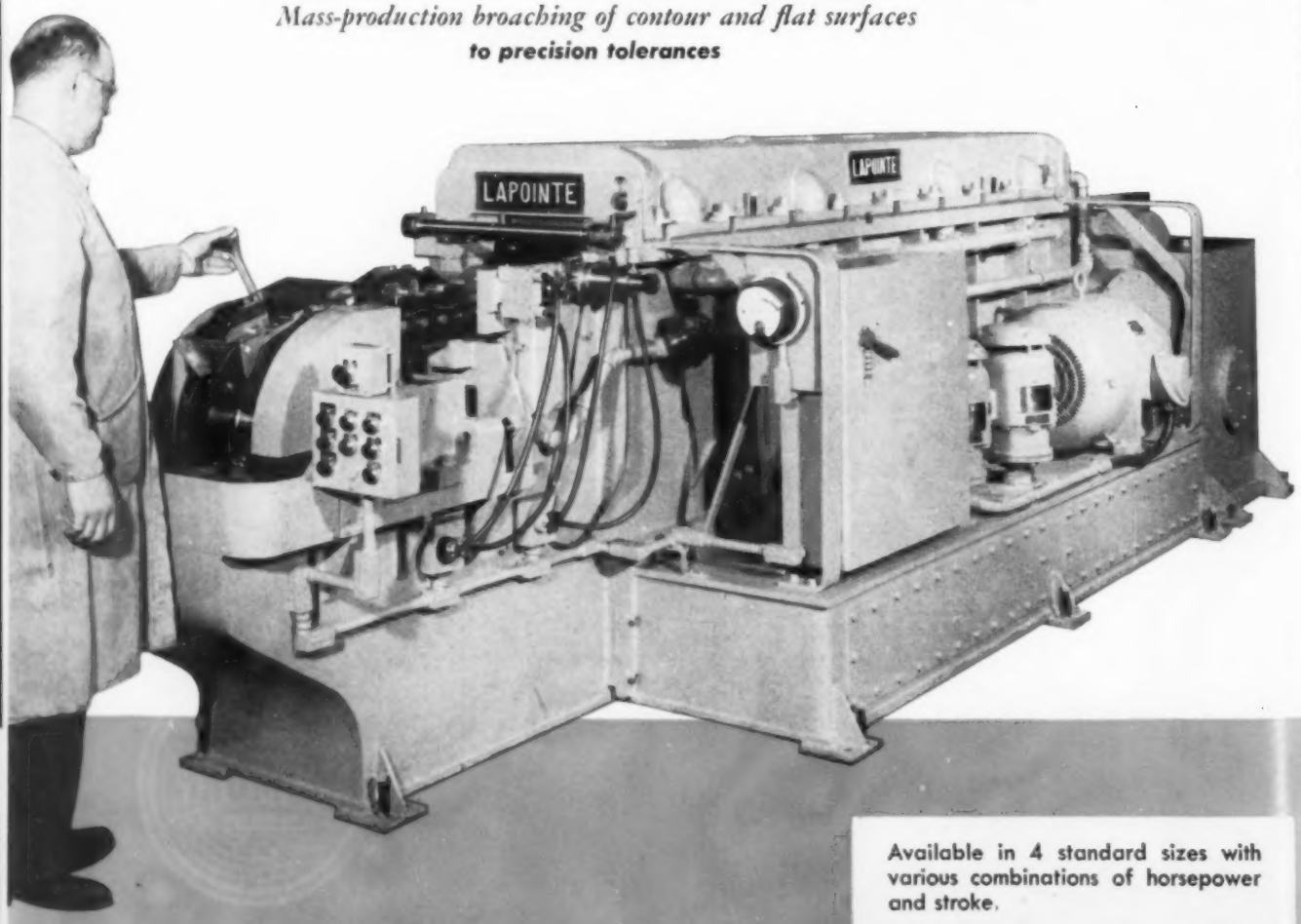

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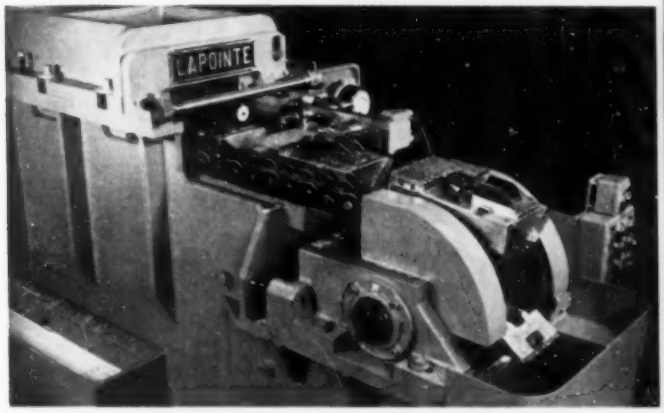
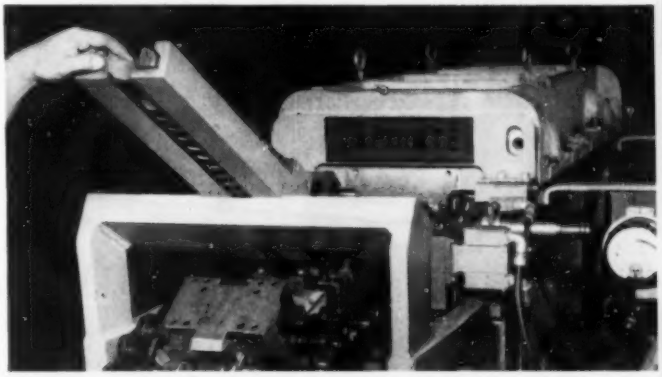


Front of machine, showing safety stop (the round white disc under Lapointe name-plate.) This safety stop assures positive positioning of parts in fixture. Note accessible chip trough.



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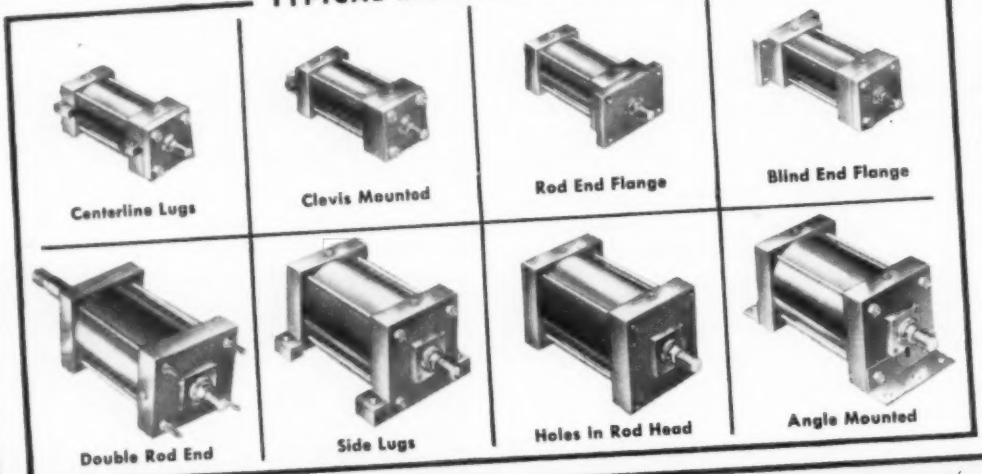

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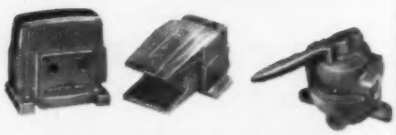

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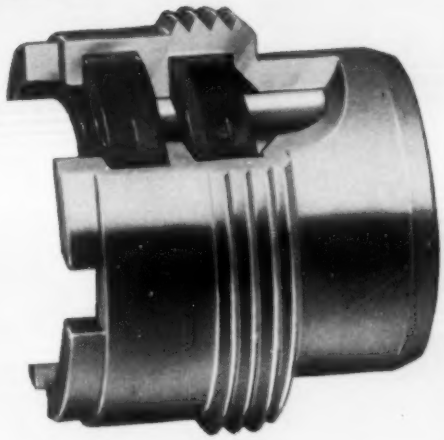

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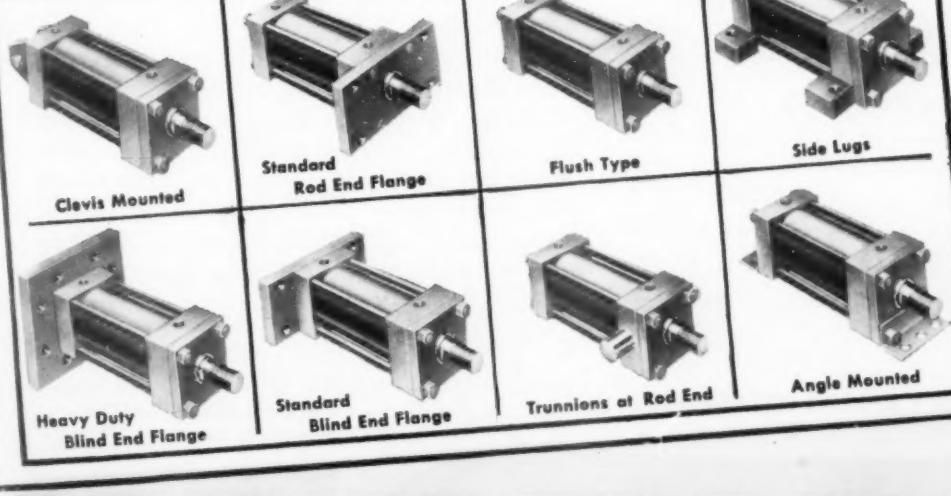

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The Tool Engineer

Investing in the Future

We have recently announced the winners of our Annual Student Scholarship Awards. The purpose of these awards is to aid in the development of competent tool engineers through education. Each of the ten winners received $700 which should go a long way in helping solve the student's financial problems. This is the fifth year your Society has granted these awards to future tool engineers.

Not to be overlooked are the individual education scholarships given by the local chapters. Most of our 119 chapters have scholarship awards to deserving students. This growing interest in aiding future tool engineers in acquiring their knowledge is one of our contributions to the future standard of living of our civilization.

Another investment in the future is our Research Fund Committee. This committee has just announced its first research project. I believe that our Research Fund Committee has passed through its "growing pains."

We have been so anxious to get the best available talent to run this important project, that our progress has been slow. Now, the committee is well organized with a capable director. New projects and research contracts will shortly be forthcoming.

Scholarships to help embryonic tool engineers and research to assist practicing tool engineers are investments by the American Society of Tool Engineers to guarantee that our standard of living will continue to improve for the benefit of society.

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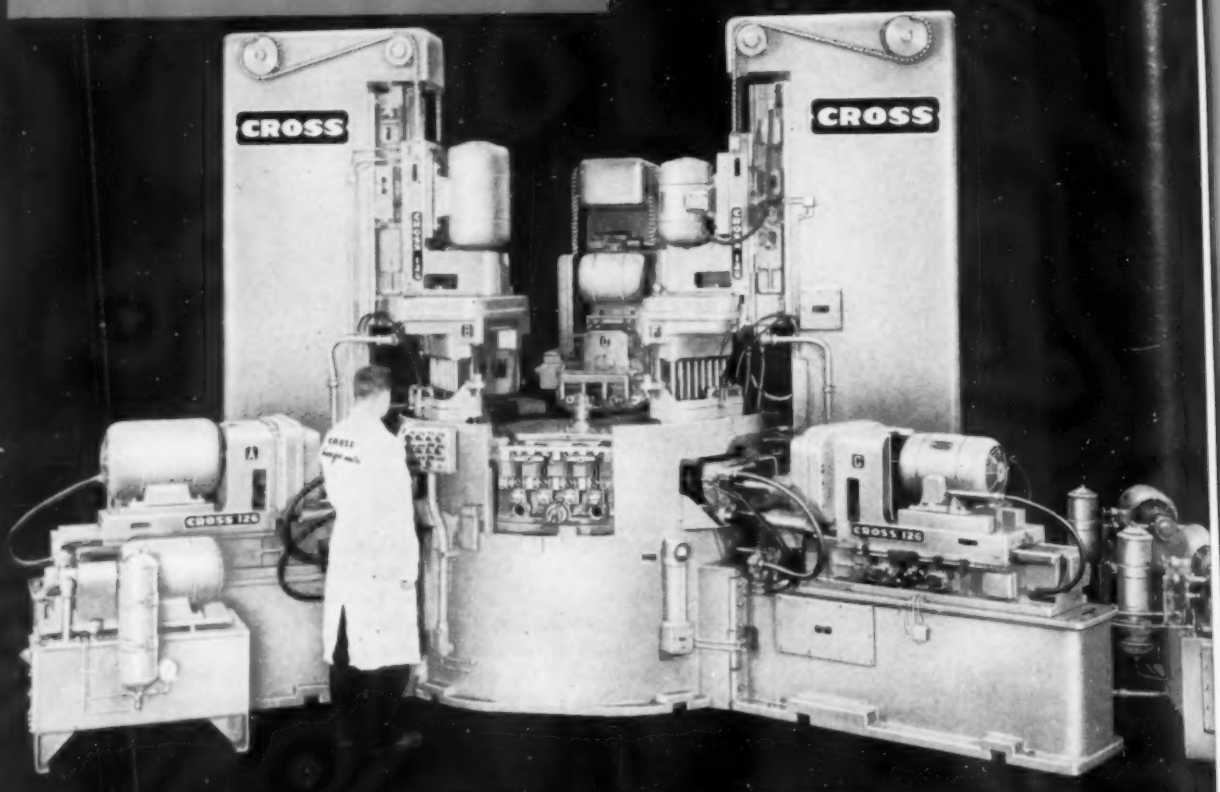

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Special MACHINE TOOLS

chip control

how to determine tool feed to obtain desirable chip form

By B. L. ten Horn and R. A. Schuermann

Philips Industries
Eindhoven, The Netherlands

Because controlling feed and depth of cut can produce desirable chip forms in turning operations, chip breakers are not recommended by the authors. To obtain best performance from a chip breaker, individual designs should be developed for each job, a costly procedure for short production runs. Also, the critical feed —when chips become fragments—is proposed as a criterion of machinability.

SHAPE OF THE CHIPS produced in metal cutting did not present a serious problem when cutting speeds were low and chips were produced at a slow rate. The operator could control the flow of chips even under unfavorable conditions. Nevertheless, the operator often ground his tool in such a way as to produce an agreeable shape of chip.

With the introduction of carbide tools, cutting speeds have increased to such an extent that chip control has become a problem. The chip leaves the work at a speed that is dangerous when the chip form is unfavorable. Tool, tool support and workpiece may become severely entangled in the chip, causing serious delay and even damage to tool and workpiece, as well as being a hazard to operators.

A high cutting rate produces a great quantity of chips in a short time. It is important to produce chips that occupy little space in relation to their weight. Henriksen[1] expresses the character of the chips by the bulk ratio, R, as

$$R = \frac{\text{Volume of chips}}{\text{Volume of solid material}}$$

Entirely unbroken chips have a bulk ratio of $R = 50$; for tightly wound chips, $R = 15$; and for well broken chips, $R = 3$.

Well-broken chips may be regarded as the most desirable and tightly-wound chips are preferred to long stringy ones. The practical importance of the

1. References are listed at end of article

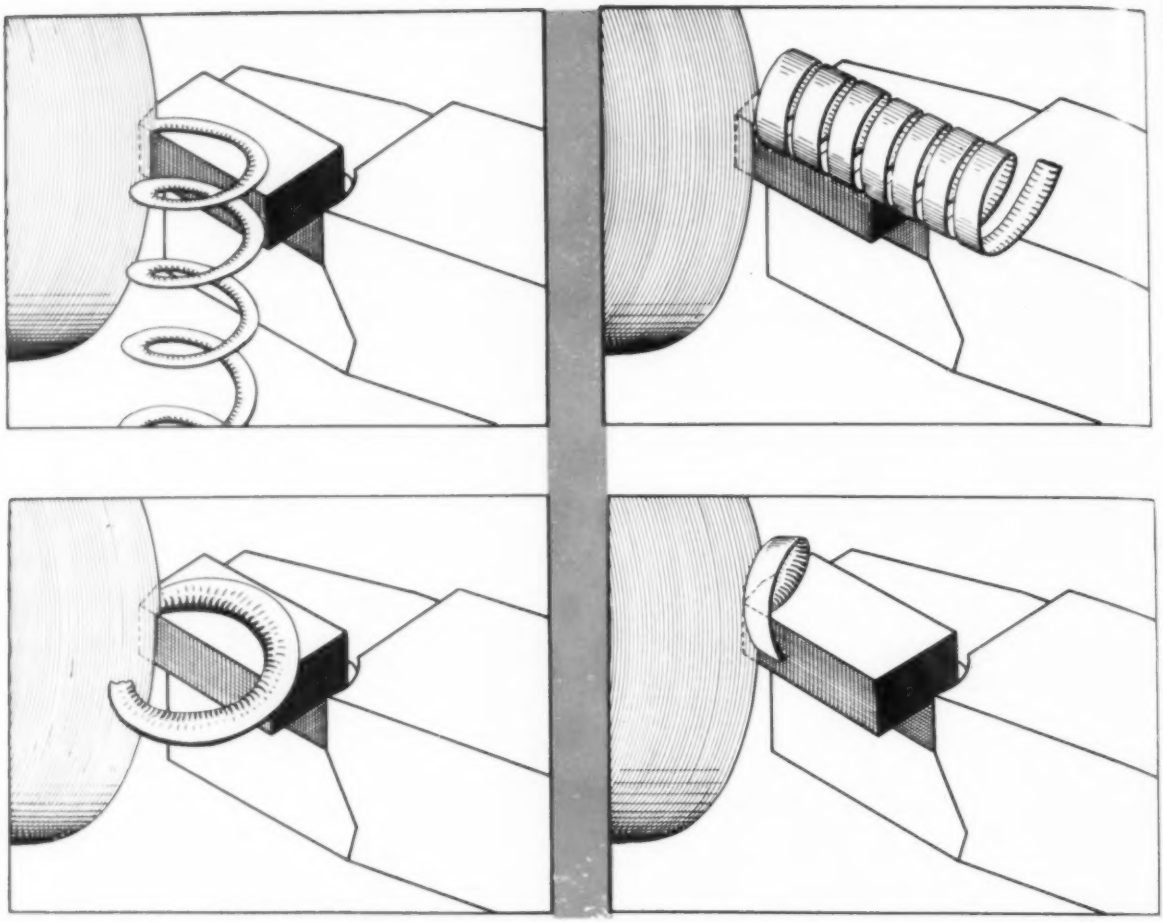


Fig. 1. Generation of two types of helical chips. At left are flat helical chip and fragment. At right are cylindrical helical chip and fragment. These four forms are produced without chip breakers.

shape of the chip warrants its being considered in the search for optimum cutting and tool design.

Methods of Chip Breaking

Chip Breakers: A well-known method of chip control is achieved by means of the so-called chip breaker. A groove or step is ground into the cutting face of the tool, interfering with the natural flow of the chip. The chip breaker imposes considerable curvature on the chip, generally forcing it to collide with an obstruction, producing chip fracture at short and regular intervals. The tabulation at right gives data for chip breaker dimensions recommended by an American carbide tool manufacturer. Accompanying this table are the comments:

> This table suggests the starting point for width of a chip breaker for various feeds and cuts. The figures cannot be exact because the breaking characteristics of the chips vary so much with the different types of steel and other "long chip" metals. Start with the width as given in the chart, then widen or narrow the chip breaker according to the results obtained while machining.

Because alteration of chip-breaker dimensions is a costly and time-consuming grinding operation it would be more practical to adjust chip dimensions, feed and depth of cut to a given chip breaker than to adjust the chip breaker to the cutting conditions. Even so, chip breakers would have to be adapted to ranges of workpiece materials and cutting conditions. This means that a relativity large variety of chip breakers would be needed.

A large number of tool types severely complicates tool maintenance and increases costs. In shops

Recommended Width of Chip Breaker

Depth of Cut (inch)	Feed (ipr/1000)				
	8-12	13-17	18-22	23-27	28-32
	Width of Chip Breaker (inch)				
1/64–3/64	1/16	5/64	3/32	7/64	1/8
1/16–1/4	3/32	1/8	5/32	11/64	3/16
5/16–1/2	1/8	5/32	3/16	13/64	7/32
9/16–3/4	5/32	3/16	7/32	15/64	1/4

Note: A chip breaker depth of 0.02 inch is satisfactory for most types of steel.

with a variety of small-lot work, the difficulties become insurmountable and the costs prohibitive. Production of broken chips can be realized simply and at considerable savings without recourse to ground-in chip breakers.

Increased Feed: Under conditions where the use of ground-in chip breakers cannot be considered, a favorable type of chip or even a completely broken chip may be obtained by simply increasing the feed in relation to the depth of cut.

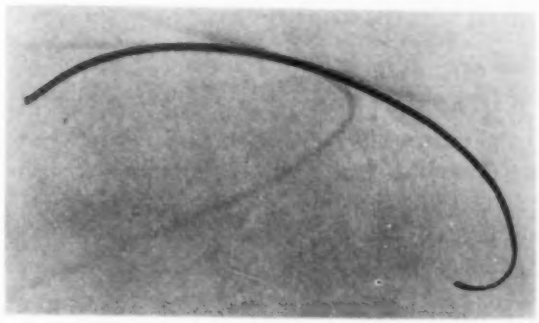
Tool angles, especially the rake angle, have an important bearing on the type of chip produced. Small or negative angles as used in carbide turning are favorable for the production of broken chips. At a positive rake angle of 4 degrees, a completely broken chip may be obtained without the use of chip breakers on normal steels ranging from free-machining to heat-treated nickel-chromium types simply by increasing the feed f in relation to the depth of cut d or, in other words, by decreasing the section ratio d/f.

In the Philips shops, where chip breakers are not used, the shape of the chip is an important consideration in the choice of cutting conditions. A certain depth of cut is chosen and then the feed is increased until a completely broken chip, or at least an acceptable type of chip, *Fig.* 1, is produced. If the feed cannot be increased sufficiently because of the limitations imposed by machine and tool, the process is repeated with a smaller depth of cut.

This means that the chip dimensions are determined by the maximum value admissible for the chip section df and the section ratio d/f. Whenever possible, the section ratio d/f is chosen on the basis of the shape of the chip.

In fact, this well-established shop practice has led to systematic investigation of the influence of the ratio d/f on the shape of the chip.

Effect of Feed on Shape: When the chip leaves the cutting edge, it develops a more-or-less pro-



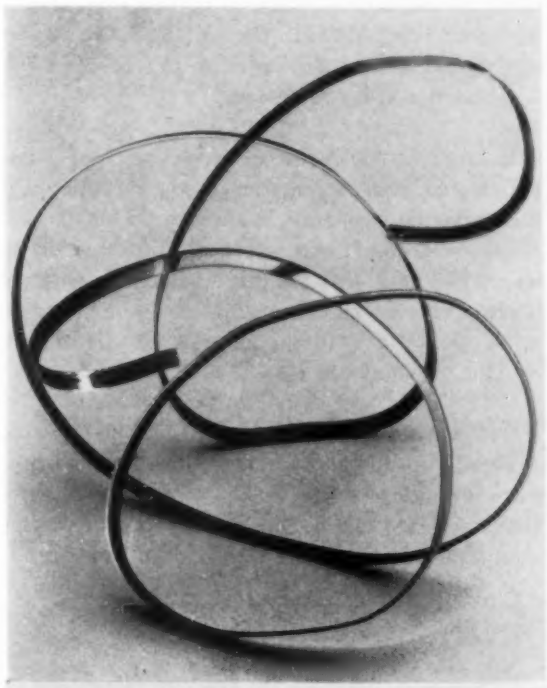
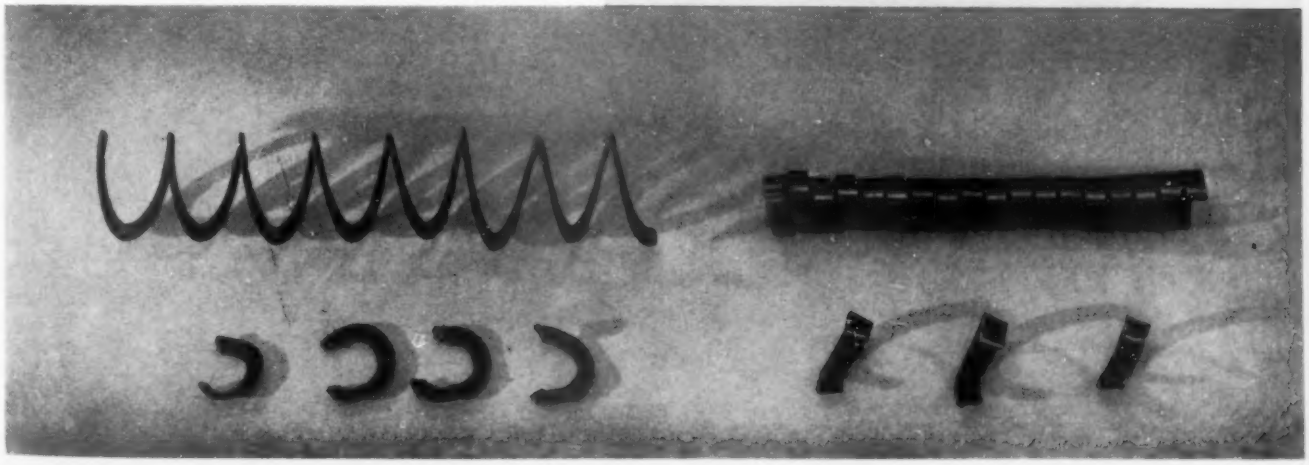


Fig. 2. (top) Straight chip produced by small feed in relation to depth of cut.

Fig. 3. (center) The snarl chip is produced by a small feed and is a shop hazard.

Fig. 4. (below) Typical flat and cylindrical chips with corresponding fragments for each. These are ideal chips.



nounced curvature. The extent to which the chip is bent and the direction in which it is bent determine the type of chip and the way it flows from the tool.

STRAIGHT CHIP: At a small feed in relation to the depth of cut, or a high section ratio d/f, curvature is slight or absent and straight stringy chips are formed, *Fig.* 2. This chip form is undesirable and dangerous.

SNARL CHIP: When the feed is increased, a slightly curved chip results. This chip has a strong tendency to get entangled in the objects surrounding the tool. Obstruction to the chip flow causes further unsystematic deflections. This type of chip, *Fig.* 3, is mentioned by Henriksen.[1]

HELICAL CHIPS: A further increase of feed causes the chip to bend in a more systematic fashion. At this stage the curvature is pronounced and helical chips are formed. According to the direction in which the chip is bent, two essentially different types of chip may be formed, *Fig.* 4, which may be called the flat helical chip and the cylindrical helical chip; both are acceptable in many cases.

Generation of Helical Chips: In contrast to the straight chip and the snarl, the two helical chips leave the tool in a well-defined direction. This, together with the much smaller bulk ratio or greater compactness makes these chips much more desirable. The way in which each form leaves the tool is illustrated in *Fig.* 1.

FLAT HELICAL CHIP: The flat helical chip bends away from the workpiece and moves off the tool along a course approximately parallel to the cutting face. In its winding motion the chip rubs against the workpiece and the tool in the corner formed between the workpiece and the clearance face.

Pressures exerted on the tool must be considerable as evidenced by the heavy wear that occurs when the point of contact lies on the soft shank below the carbide tip.

Workpiece and tool together act as a guide for the chip and steady its flow. The chip leaves the tool downwards, roughly at a right angle to the tool shank and the axis of the lathe.

FLAT HELICAL FRAGMENTS: When the feed continues to be increased the chip flowing from the tool breaks into fragments of barely one coil of the helix. The successive phenomena take place at too great a speed to permit detailed observation without the help of facilities such as high-speed cameras.

Apparently, the chip collides head on with the workpiece. This obstruction to the chip flow causes fracture of the chip at or near the cutting edge. These helical fragments may be considered as an ideal shape of chip.

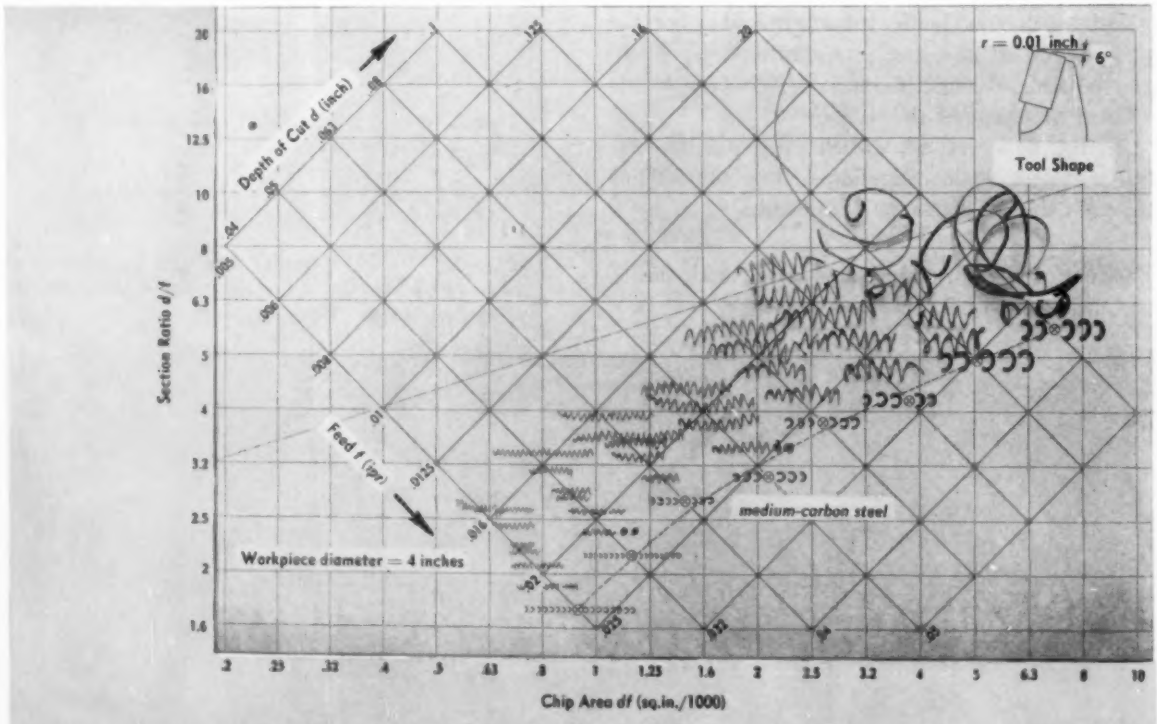


Fig. 5. Chip forms leading up to the completely broken chip for medium-carbon steel.

CYLINDRICAL HELICAL CHIP: The other type of helix, the cylindrical helix, is formed when the chip is bent up, away from the cutting face. As the chip curls up in its winding motion it turns back toward the cutting face. It probably makes contact with the tool at the completion of the first turn. This point of contact may act as a guide to the chip, accounting for the stable and regular type of flow that is observed.

Unfortunately it is difficult to prove the existence of such a point of guidance, because the contact, if any, will be on the carbide and cause little wear. Clear wear marks were not observed during tests. In contrast to the flat helix, the rotational axis of the coil is roughly parallel to the cutting edge and the chip leaves the tool horizontally in the direction of the toolholder.

CYLINDRICAL HELICAL FRAGMENTS: Broken chips are produced by increasing the feed. The chip, returning toward the tool at the completion of one turn runs into the clearance face instead of sliding over the cutting face. The obstruction resulting from the head-on collision causes fracture of the chip and helical fragments are produced. This fragment chip is also ideal.

The occurrence of true spirals (watch-springs) suggests that this type of chip may also start winding into itself, getting into the corner between tool and workpiece until fracture is bound to occur.

Test Conditions: A bar of the material was first turned to remove scale and decarburization. A series of turning tests was made by starting with a large depth of cut and a small feed, conditions unfavorable for producing broken chips. Subsequently the feed was increased without changing the depth of cut until a completely broken chip was obtained. The same procedure was repeated decreasing the values of depths of cut until a broad range of values for both chip dimensions was completely covered.

Every turning operation was continued long enough to collect a representative sample of chips.

The tool used for the experiments was a lead angle turning tool having the following description:

Side rake	4°
Clearance angles	4°
Cutting edge angle	15°
End cutting edge angle	6°
Back rake	0°
Shank	1" x 1"
Carbide type	C-7

This tool is standard in the Netherlands and is designated: HCNN V1720 R 25x25. The nose radius was kept as small as practicable, i.e., 0.01 inch.

Because tool wear has considerable influence on the character of the chips, it was necessary to resharpen the tool frequently. By repeating a test with the resharpened tool, the effect of tool wear was estimated and kept under control. The critical feed,

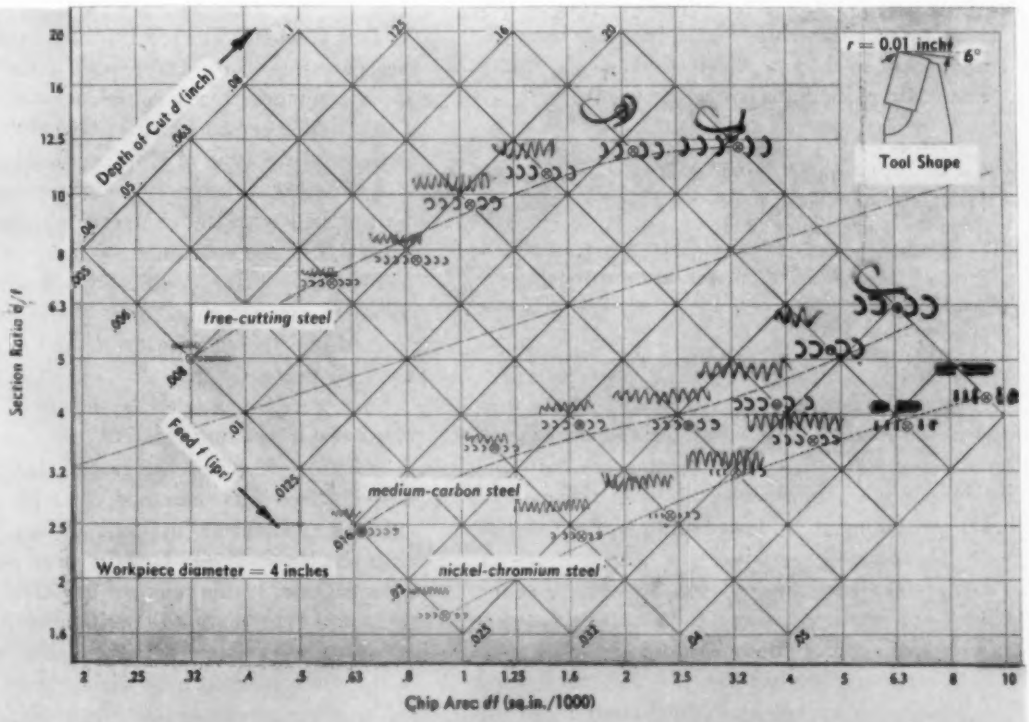


Fig. 6. Critical chip breaking feeds for various materials with 4-inch diameters.

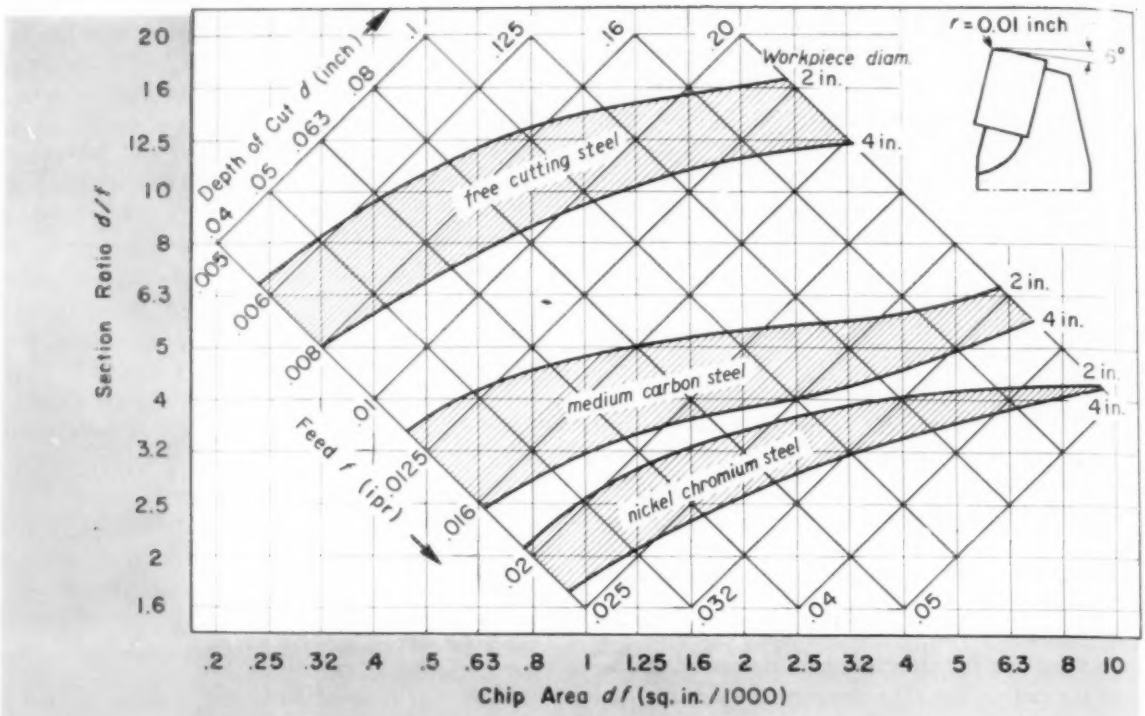


Fig. 7. The influence of workpiece diameter on critical feed.

at which a completely broken chip is produced, was always checked with a freshly ground tool.

In the experiments the depth of cut was varied from 0.2 to 0.04 inch. The feed was, where possible, chosen to produce chip forms ranging from the straight chip to the completely broken one, *Fig.* 5.

Four workpiece materials were tested:

Steel	Percent Compositon
Free-Machining Steel	0.1 C 0.25 S
Medium-Carbon Steel	0.45 C
Nickel-Chromium Steel (120,000 psi tensile strength)	0.35 C 1.2 Cr 4.2 Ni
Free-Machining Medium-Carbon Steel (DIN 35S20)	0.35 C 0.2 S

These materials were chosen because of the well-known differences in their chip-forming tendencies. The cutting speed was kept constant at 500 fpm throughout the experiments. Only in the case of nickel-chromium steel a lower speed of 300 fpm had to be chosen.

Exploratory tests have shown, however, that the influence of small variations in the cutting speed is only of minor importance.

In the course of the experiments, the data showed that the size of workpiece has an influence on the type of chip. The influence of diameters ranging from 4 to 2 inches was investigated.

Every set of results was obtained from one single sample of steel. This is necessary because different bars of nominally identical steel may give different results.

Test Results: The results of the experiments may be represented in a graph with d and f plotted as the coordinates. Every combination of values d and f would be represented by a point in the graph. For each point the type of chip produced can be given.

A different and equally useful representation may be graphed with the chip area df and the section ratio d/f as the coordinates. These graphs may be combined by using double logarithmic coordinates in which case the coordinates d and f can be transformed into the coordinates df and d/f by rotating them 45 degrees.

Such a representation is shown in *Fig.* 5. The chips resulting from the different combinations of d and f are shown on the graph. The graph shows how the feed was increased, keeping the depth of cut at a constant value, until a completely broken chip was obtained and how the same procedure was repeated over a wide range of depths of cut. Finally the points representing the critical chip dimensions, at which a completely broken chip was just obtained are connected by a dashed line.

The same results are shown in *Fig.* 6 for three different materials. Only the completely broken chip and the chip obtained at the preceding smaller feed are shown. All these tests were on bars of 4-

inch diameter. Both cylindrical and flat helical types of chips were produced.

The graph demonstrates that free-machining steel produces broken chips more easily, i.e., at a higher section ratio, than nickel-chromium steel, with medium-carbon steel in between.

Similar results are obtained when the same bars are turned to a diameter of 2 inches but the chip breaking feeds are smaller, indicating that on a smaller diameter the chips are broken at an earlier stage.

In *Fig.* 7 the results of the two preceding tests are combined. At diameters between 2 and 4 inches chip breaking feeds will remain within these two limits.

The graph in *Fig.* 8 gives the results obtained on a shaft of free-machining medium-carbon steel (DIN 35S20) compared with those of the previous experiments. The diameter of the bar was 4 inches.

In contrast to the preceding tests, chips were of the cylindrical helical type without exception. The curve connecting the chip breaking feeds has a completely different character.

These tests show that under certain constant conditions, including a standardized type of tool, systematic relations can be found between the dimensions and shapes of the chips. These relations are reasonably simple and reproducible.

In the range of chip sections covered by the tests completely broken chips can be obtained on all the currently used types of steel ranging from free-machining to heat-treated nickel-chromium.

The section ratio d/f is the major factor governing the shape of chips.

Practical Application

In investigations throughout the world, data have been collected to promote the optimum use of tools and machines. The relations between cutting speed, chip dimensions and tool life have been determined for different tool and workpiece materials.[2] Also, the power requirements and tool forces have been investigated to aid in the design of machine tools. In these investigations, however, the chip section ratio appears to have been arbitrary.

In *Fig.* 9 are shown section ratios calculated from the machining recommendations of three leading carbide manufacturers. It is striking that these ratios compare closely with the results of the Philips tests. It would appear that in some way the shape of chips must have been considered in the choice of these data. No reason is ever given, however, for the choice of ratio. Section ratio still presents a degree of freedom which may still be eliminated someday by the addition of a new relation. This means that it is possible to incorporate chip breaking data into tables and nomograms to give relations between the factors of the cutting process. In fact, such tables and nomograms remain ambi-

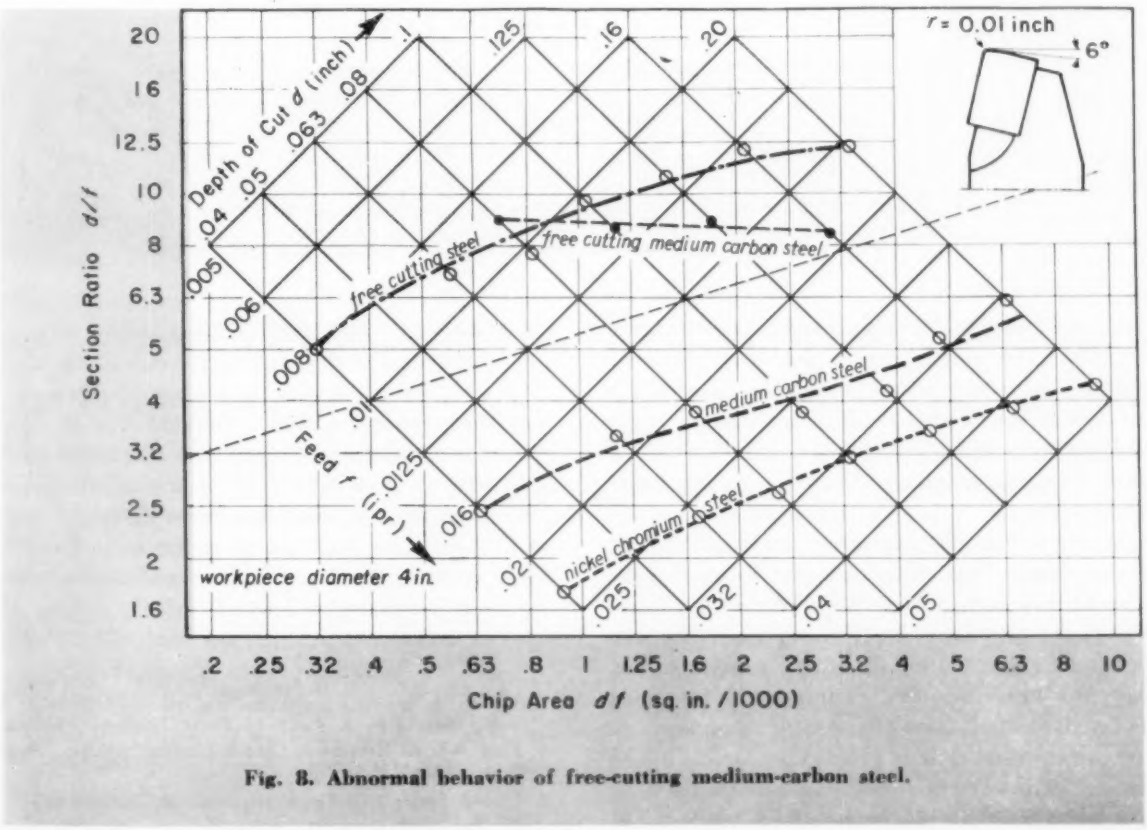


Fig. 8. Abnormal behavior of free-cutting medium-carbon steel.

guous as long as section ratios are not considered.

To put the results of these investigations on chip breaking into practice simply of incorporating section ratios into tables and nomograms as an aid in the choice of cutting conditions.

A Criterion of Machinability

In spite of the fact that the property of materials termed as "machinability" is economically of the utmost importance, research has failed to bring about universally satisfactory methods for its measurement. The reason is that machinability is no well-defined quality of the workpiece material but a combination of several of its properties. Which of these properties is most important depends on the type of cutting operation and on the cutting conditions.

Nearly all existing tests measure machinability by one or more of the strongly interrelated following factors: tool wear, tool temperature, cutting forces and power consumption. These machinability tests fail to take into account the widely recognized fact that two other important factors—chip formation and surface finish—are ofen equally important. In some operations, such as profile turning and thread cutting, chip formation may even become the decisive factor.

These experiments show that a systematic relation can be found between chip form and chip dimensions. Different materials can be made to produce broken chips of the same type by decreasing the section ratio to the appropriate value. The magnitude of the d/f ratio at which a predetermined type of broken chip is produced under given cutting conditions shows promise of becoming a new machinability parameter.

In the curves of *Fig. 8*, free-machining steel, medium-carbon steel and nickel-chromium steel can be classified by their chip breaking section ratio at an arbitrary value of the sectional area of the chip. The abnormal curve of free-machining medium-carbon steel, coinciding with a different type of chip, presents a serious difficulty. The classification of this type of steel in relation to the others would depend entirely on the chip section chosen.

The practical importance of the chip forming characteristics as an aspect of machinability warrants further investigation.

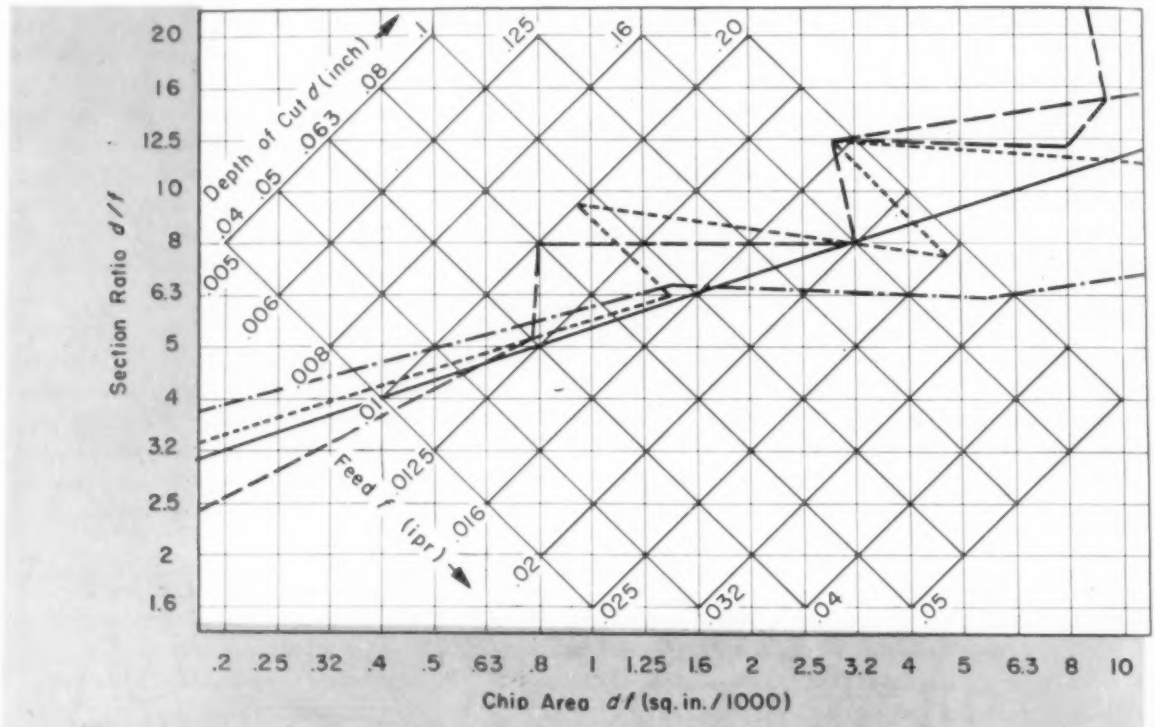


Fig. 9. Chip section ratios calculated from existing recommendations.

References

1. "Chip Breaking—A study of Three Dimensional Chip Flow"—E. K. Henriksen, Cornell University, Ithaca, New York; ASME Paper 53-S-9.
2. *United States Air Force Machinability Report 1951*—Curtiss Wright Corp.

Gadgets

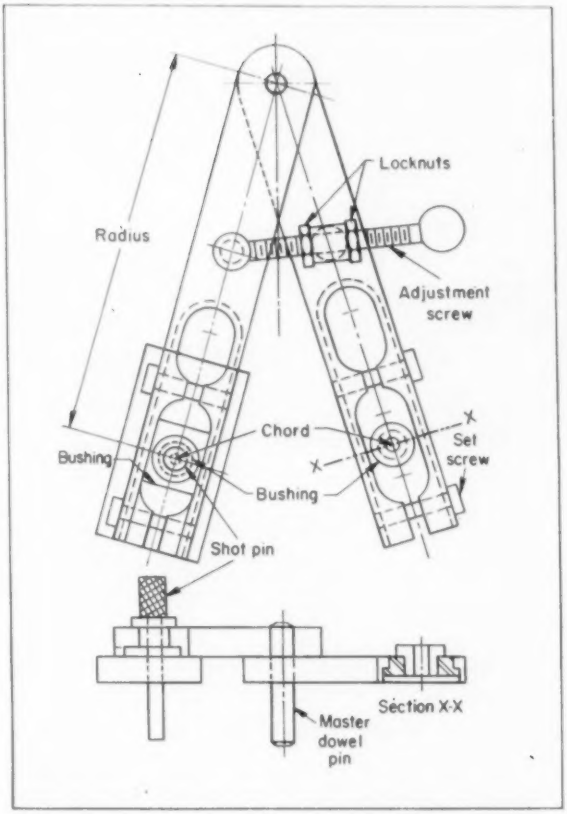
Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Chord Bar for Radial Holes

The chord bar shown in the accompanying drawing was made to locate radially spaced holes to a greater degree of accuracy than secured by the conventional dividers method of step and try. Other uses can also be found for it in layout and tool work.

The device should be constructed to handle the radius and chord desired, though it is adjustable over a limited range. The adjustment screw should have a fine thread to secure close settings. All pins and other component parts must fit tightly and accurately to obtain desired accuracy, as any error will be multiplied in the movement. The master dowel pin and shot pin fits are especially critical. After the chord bar is once set up it can be used as a permanent drill jig for that particular part until the shot pin and drill bushing become worn so badly that they no longer produce the tolerance required.

To secure the setting the true radius of the circle is set on a height gage with indicator attached and the legs of the chord bar are set to that radius. The chord dimension is determined for the number of hole spacings desired, by reference to a handbook which usually provide accuracy to five places. After the chord is set between centers of the bushings, location of the holes is purely mechanical. The bars are set in position with the shot pin through the first hole in the workpiece.



The next hole is then drilled through the bushing and the operation repeated until all holes have been drilled.

C. T. Beall
Kansas City Chapter

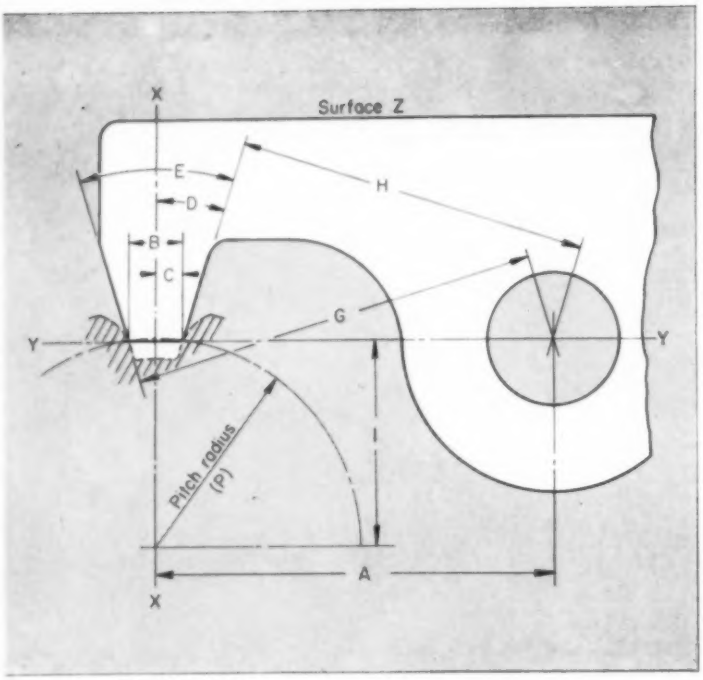
Gear Locating Pawl

Sometimes it becomes necessary to locate a gear accurately in relation to some other point in an assembly, such as a tooth space of one gear to another, or a tooth space in relation to a cam or work arm. Usually the practice is to make a pawl or locator to suit. This often results in gross inaccuracies because the pawl or locator fails to contact the tooth space on the pitch line.

The method shown has been proved many times through actual use. The locator can be made by simple toolmaking methods and ground to dimension on an ordinary surface grinder.

In laying out the gear and locating pawl, line *X-X* is first drawn, intersecting the center of the gear and the center of a tooth space. Then line *Y-Y* is drawn at right angles to *X-X* intersecting the tooth at the point of contact. Dimension *A* can be any practical dimension the designer chooses. Dimension *l*, of course, is controlled by the gear

Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Payment for accepted articles is made upon publication.



being located. Surface *Z* should be ground and the pivot hole lapped to size to facilitate checking, usually on a sine bar. The other dimensions are:

B = thickness of tooth on pitch line

C = B/2

D = pressure angle + (90 ÷ no. of teeth)

E = 2 D

G = (A + C) cos D

H = (A − C) cos D

$I = \sqrt{P^2 - C^2}$

Because it is easy to spread the teeth and spoil a gear by overclamping or using a screw that will exert too much pressure, the method of holding the pawl in contact with the gear is critical. Some sort of ratchet or spring-loaded screw should be used in order to prevent damage to the gear teeth.

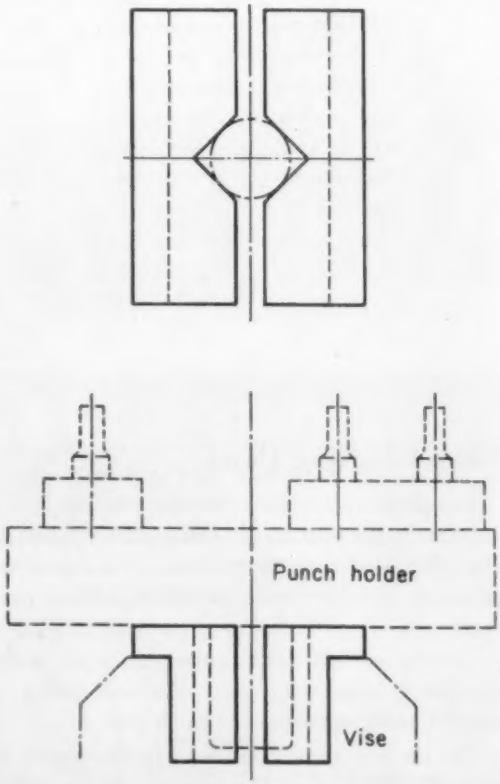
A. C. Good
Dayton Chapter

Auxiliary Vise Jaws

The usual method of holding punch holders of die sets to a machine table is with parallels and strap clamps. If the punch holder has to be moved for another operation, then the die maker must loosen the nuts on the clamps, line up the spindle and then reclamp it. Illustrated is a simple way of speeding up this time-consuming procedure without sacrificing rigidity or efficiency.

Two hardened steel V's are made as auxiliary jaws for the machine vise, to clamp around the punch holder shank, thus holding it securely in place while the various operations are performed. Since the diameters of punch holder shanks vary, the V's should be made to take the largest size, which will then take anything smaller simply by moving the vise jaws closer together. The jaws may be serrated if desired to provide greater gripping pressure.

Roger Isetts
Kenosha, Wis.

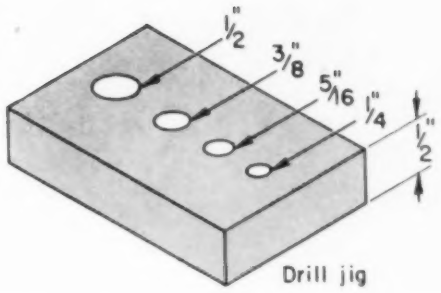


thod for Layout of Holes

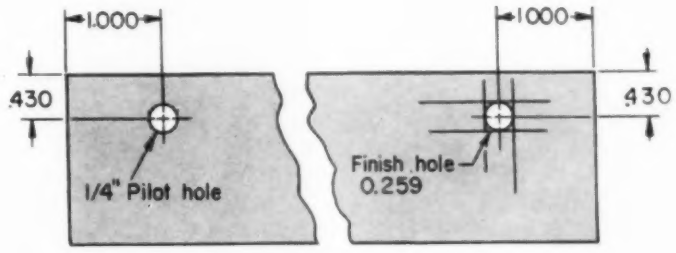
In laying out holes where only a minimum error is permissible, the following method was found satisfactory. A hardened block with lapped holes is used as a drill jig. On a typical dieblock a square outline of the ¼-inch pilotholes is drawn as shown.

The jig is put over the block and shifted until the ¼-inch hole is centered over the ¼-inch square. The jig is clamped and the pilothole drilled. The hole will appear boxed as shown on the right side of the die block. With a good height gage and a drill press, close tolerances can be maintained.

Arne Nielsen
North Vancouver, British Columbia



Drill jig



Die block

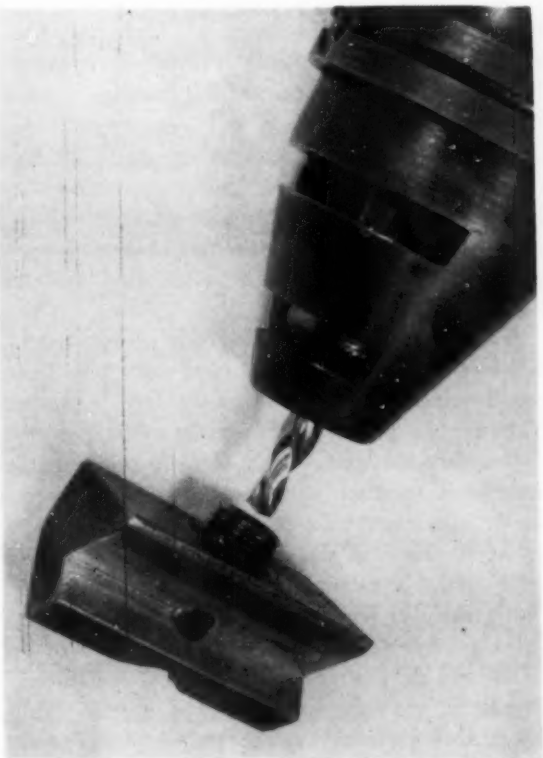
Chamfer Guide

Hand filing chamfers on sheet metal aircraft parts is a tedious and time-consuming job. The guide pictured makes it possible to use ½-inch air routers for the operation. By using this device, officials at Tempco Aircraft estimate annual savings of $3000.

The guide, designed to rout a 45-degree chamfer, consists of a one-by-two-inch notched steel block fastened to the end of the router. To get the desired angle, a 90-degree triangular notch is milled in one side of a proper sized blank. The notch is produced at 45 degrees to the router blade which passes through a hole bored in the center of the block. The blade is exposed where it intersects the point of the triangular notch. The hole that encloses the blade is threaded at one end so it can be screwed to the end of the router as shown.

By pressing the notch snugly against the edge to be chamfered, the operator is assured a quick and uniform cut. Notches can be cut to provide any desired chamfer angle. Depth of chamfer is controlled by the degree to which the router blade is exposed at the point of the notch.

William Childress
Dallas, Texas



GYPSUM CEMENT PATTERNS
simplify die sinking

By M. K. Young

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—*Photo courtesy Pratt & Whitney*

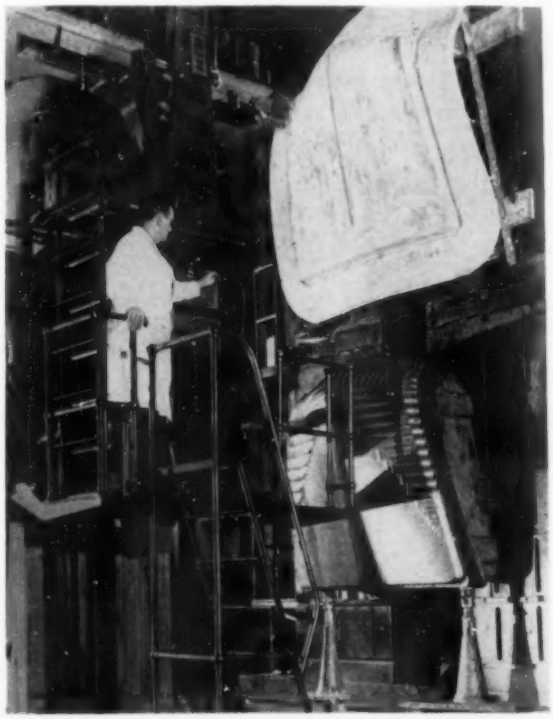


Fig. 1. Large die sinking model fastened to angle iron base is being used to produce a male die with Keller-type machine.

ONE OF THE MAJOR PROBLEMS in forging large parts on a production basis is the time and facilities required for die sinking. While automatically controlled die sinking machines are available to provide both the "brains and muscle" for extremely sensitive, high fidelity tracing needed to meet exacting tolerances, traditional pattern making methods have been found wanting.

The master pattern, sometimes referred to as the duplicator or Keller, generally used to machine the shape of the die cavity, must be an exact counterpart of the desired shape. Furthermore, during the die sinking operation the tracing pressure applied upon the pattern surface will vary from a few ounces to several pounds, depending upon the type of equipment being used. Since machining cuts are taken transversely by means of saddle movement or longitudinally with the table movement, additional requirements are introduced for the pattern.

While patterns are conventionally made of metal, wood or plaster, the material must meet three basic requirements to provide a satisfactory die sinking pattern: (1) accuracy, (2) surface smoothness and (3) surface hardness. These three factors must be considered together and not individually, as accurate dies cannot be produced if the pattern is below standard in one respect. Plaster has long been used for pattern, model and mold making. Until recently, however, there was only one material, plaster of Paris. Today, as a result of research and development, a variety of scientifically formulated gypsum cements afford special qualities desired for each type of application. Properties of these cements are designed to meet the specific tooling needs of aircraft, automotive, foundry, plastics and other industries. The automotive industry in particular has pioneered in the use of gypsum cements for die sinking patterns. As a result of this experience, these newer type plasters have been developed and accepted as necessary tooling materials. Without them it would be virtually impossible to cope with present-day production schedules, since traditional wood die-sinking methods are too slow to meet demands.

The forging industry and aircraft producers have begun to draw on this pool of automotive tooling experience. They have found that gypsum

cements can provide the close tolerances required for jet aircraft forgings, *Fig.* 1.

Choice of Plaster Type

In contrast to most materials, gypsum cements give a positive expansion upon setting rather than shrinking. As this type of plaster sets, the mass begins to heat and expand. This is a natural characteristic of all gypsum cements. Through changes in the manufacturing process, the expansion is controlled to insure consistent performance in a variety of applications. The expansion plasters especially adapted to die sinking are defined by the following typical trade names (registered by U. S. Gypsum Co.).

Hydrocal A-11: A high-strength gypsum with a low-setting expansion. Setting time is approximately 30 minutes.

Hydrocal B-11: A low-setting plaster, with a high degree of plasticity and a gradual setting action. It sets in approximately 25 minutes after mixing.

Hydrocal B-11 (slow set): A very low-setting expansion plaster with a high degree of plasticity and a gradual setting action. It sets in approximately one hour. Strength and hardness are comparable with regular B-11.

Hydrostone—Hardest and strongest of all gypsum cements, has a slightly higher expansion than B-11.

Ultracal—Harder and stronger than B-11, but with lower expansion.

Because the A-11 type of expansion plaster has a short period of plasticity and stiffens rapidly, it should be used only for pouring solid models. The B-11 type is specifically designed for die sinking patterns produced by the splash cast technique. The setting time of approximately 25 minutes provides an adequate period for building up work. For very large patterns, the B-11 (slow set) form is recommended to provide additional working time

—Photo courtesy Wyman Gordon Co.

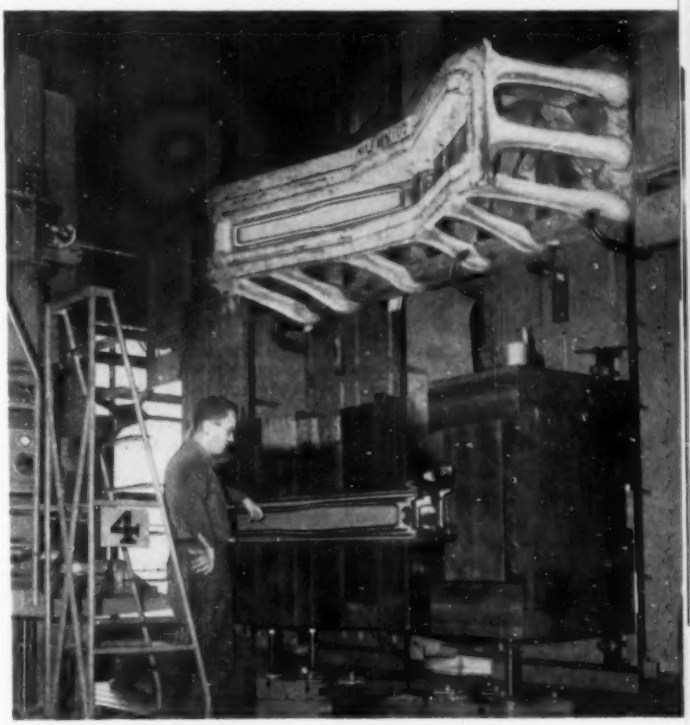


Fig. 2. Aircraft wing spar section die pattern was made by the splash cast technique. Reinforced with fiber, it is fastened to wood mounting frame with fiber ties or legs.

Table 1—Physical Properties of Die Sinking Gypsum Cements

Property	Hydrocal (Slow Set) B-11	Hydrocal A-11	Hydrocal B-11	Hydrostone	Medium High Expansion Hydrocal		Ultracol 30
Normal Consistency: (parts water to 100 parts cement by weight)	50	40-42	48-50	28-32	45	50	37
Setting Time (minutes)	60-70	20-26	26-32	22-28	30-40	35-45	25-30
Setting Expansion (inch per inch)							
Maximum	0.0003	0.0005	0.0005	0.002	0.0154	0.0104	0.0005
Average	0.0002	0.0004	0.0004	0.0016			0.00032
Compressive Strength							
Minimum Wet (psi)	2000	2200	2000	5000	1500	1200	5000
Minimum Dry (psi)	3750	4500	3750	11000	2700	2200	7250
Surface Hardness Monotron Test*—Dry	60	75	60	160	45	40	98
Acid or Alkaline	Alkaline	Alkaline	Alkaline	Alkaline	Slightly Acid	Slightly Acid	Alkaline
Slurry (pH)	10-11	10-11	10-11	10-11	4.5-5	4.5-5	10-11

*1-kg load 0.01" penetration with 10 mm diameter steel ball. Monotron hardness is eight times Brinell hardness.

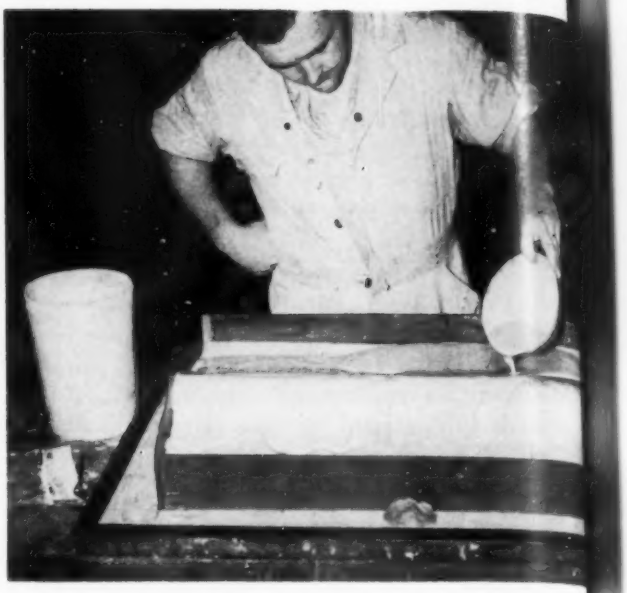


Fig. 3. (top left) Average size die sinking pattern is being poured solid in wood flask.

Fig. 4. (top right) Complex shape is reproduced in die sinking pattern by splash cast technique. The face coat of ¼ inch is being applied.

required for application of reinforcing materials. The strength and hardness are comparable to those of the regular B-11 plaster. Where the extreme in surface hardness is required, the Hydrostone type is recommended. Because of the thixotropic or sirupy nature of the material, it should be used to pour solid models or patterns. Where special formulations are required to meet specific tooling needs, Ultracol is used. It is harder and stronger than the B-11 form but has a lower expansion, making it ideal for many applications. A summary of physical properties of gypsum cements is shown in TABLE 1.

Setting time, or working time, as it is sometimes called, is an important factor in selection of the proper pattern material. For instance, while the A-11, B-11 and Hydrostone types of plasters provide satisfactory working time for fabrication of patterns ranging from 12 by 12 inches to 3 or 4 feet in length and width, with the larger patterns, such as shown in *Fig.* 1, a longer set is needed.

Such large patterns are cast from B-11 (slow-set), which provides a 60-minute setting time. This not only gives additional time for fabrication, but also the lowest expansion of all gypsum cements used in pattern making. The low expansion is desirable on large patterns to meet the close over-all tolerances and specifications in automotive and aircraft work. In the Air Force heavy forging program, for instance, the B-11 (slow-set) plaster has been generally favored because of the necessity of reinforcing with fiber and tying in the patterns to a wood mounting frame with fiber ties or legs, such as shown in *Fig.* 2. This operation requires additional working time.

Fabrication Techniques

Die sinking patterns are made either by the pouring method or by the splash cast technique. The pouring method is generally confined to small patterns 2 to 3 inches thick. Typically, Hydrocal A-11 and Hydrostone are used for poured patterns, as illustrated in *Fig.* 3. As indicated by the material characteristics and properties in TABLE 1, A-11 is more accurate than Hydrostone, but the latter is harder and stronger.

The splash cast technique is used for making large die patterns and is particularly adaptable to deep sections or contoured designs. Patterns in *Figs.* 1 and 2 were made by the splash cast technique. Before pattern can be made by this method, reference and trim lines are scribed on the original model so they will transfer to the pattern. The original model may be metal, wood, gypsum cement, or hand-sculptured clay. It should always be given two coats of lacquer to seal the surface. When the lacquer dries, a thin coating of parting compound is applied. Heavy cardboard or ¼-inch plywood strips are cut and assembled to form a box or retaining wall around the model. The box is oversize and extends above the model surface 1½ to 2 inches to predetermine the thickness of the die sinking pattern.

A plaster mix is then poured slowly over the surface of the model to form a ¼ to ½-inch coating as shown in *Fig.* 4. During this pouring operation, the model should be joggled or vibrated to eliminate flow marks and entrapped air. After the initial set of the first mix has progressed from the

free-flowing to the plastic stage, a second mix should be prepared. To provide additional tensile and flexural strength, fiber batts approximately 6 or 8 inches in diameter and ½ inch in thickness are dipped into the second mix and placed over the entire pattern surface as illustrated in *Fig.* 5. An average size pattern will require perhaps 10 to 15 fiber batts to reinforce it properly while larger patterns require many more.

A wood or metal frame, which serves as a structural reinforcement, is used for mounting the pattern on the die sinking machine. The frame is fastened to the pattern with fiber ties which are dipped into the third mix. It is positioned and held in place during the operation by parallel bars shown in *Fig.* 6 which are fastened to four height gage blocks. Additional mixes of gypsum cement are used to complete the pattern, *Fig.* 7. No predetermined number of mixes can be specified for the larger patterns.

Fig. 5. Fiber bat approximately ½-inch thick is dipped into the second mix and spread over the entire pattern before application of the second mix.

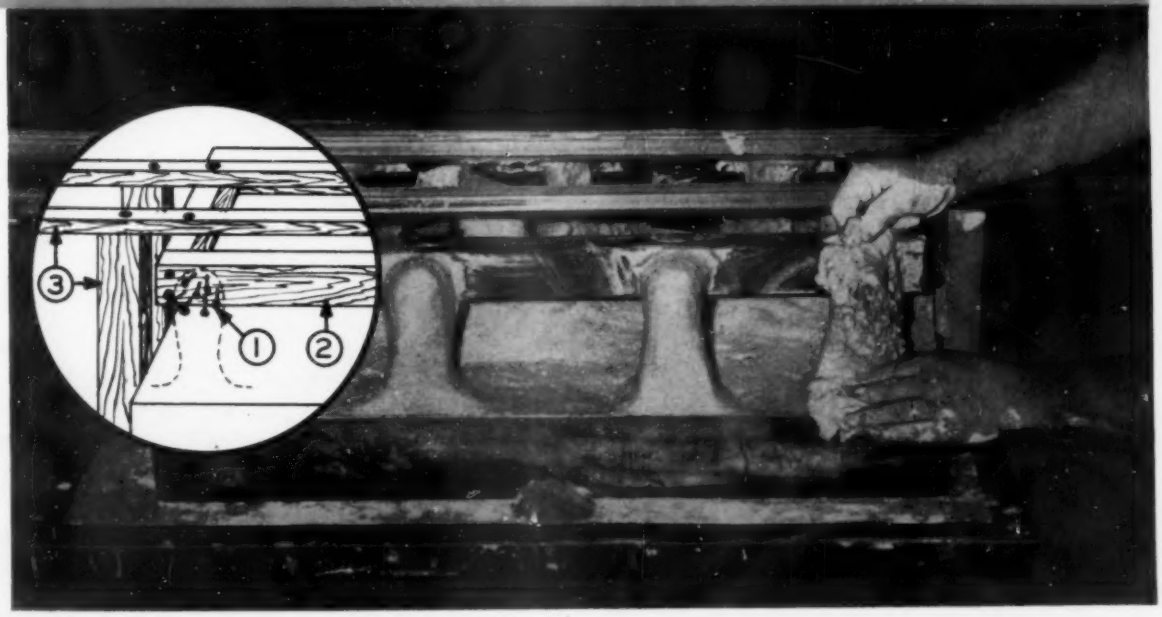
Reinforcement of Patterns

When additional strength is needed, reinforcements are incorporated in the pattern. The most versatile and widely used reinforcement is uncarded long fiber hemp. Hemp in commercial form is matted in baling so it must be picked apart to loosen the individual strands.

Wood, 2 by 4 and 2 by 6 inches, reinforcements which are used as supports for the finished pattern should always be tied to the work with fiber hemp. Kiln dried wood is recommended. It should never be embedded in the cement as a reinforcement because the moisture will swell the wood and distort the pattern. All wood reinforcements should be given at least three to four coats of lacquer before being tied onto the pattern.

The Wyman Gordon Co. has found that 1½ to 2-inch angle iron is superior to wood for reinforcements, especially for large patterns. If metal

Fig. 6. Wood frame that serves as structural reinforcement and also for mounting pattern on die sinking machine is fastened to the pattern with fiber ties. (Inset) (1) Nails for anchoring ties; (2) mounting frame; (3) height gage blocks and leveling bars for positioning wood frame during processing of pattern.



reinforcements are fabricated by welding, the frame or supporting member should be normalized to relieve stresses or strains that may occur during fabrication. The metal reinforcements are also tied to the pattern with fiber hemp batts impregnated with gypsum cement.

Drying and Storage of Patterns

Die sinking patterns can be used immediately after splash casting or pouring. In the wet or "as cast" stage, however, strength and hardness is at a minimum. Therefore, it is recommended that the pattern be dried at room temperature for several days. As the pattern dries, its surface hardness and strength increase proportionately. During the drying period and subsequent storage, the pattern should be supported properly at all times to prevent distortion.

Mounting Pattern for Die Sinking

Since each large pattern constitutes a separate problem because of its peculiar shape, it is difficult to offer specific recommendations for mounting die sinking patterns. Several general suggestions can be made that may save considerable tooling time during this operation. Many man-hours and precious tooling time have been lost in the mounting of patterns on die sinking machines. Hoisting cables should be positioned properly to prevent scoring or marking the pattern surface. Large eyebolts should be incorporated into all wood or metal reinforcing frames to position cables properly and eliminate the possibility of damage to the pattern.

Another important factor often overlooked is leveling of the pattern base frame. Many plants plane or machine the bottom of the wood or metal supporting reinforcements to provide a flat base that will closely fit the flat surface of the horizontal or vertical machine worktable. Mounting time can be reduced by ⅓ to ½ when the base of the pattern is thus leveled. The use of shims to level a base is undesirable because valuable machine time is consumed during the shimming operation. Moreover, inadequate or improper shimming often results in twisted or distorted patterns when the supporting frame is clamped to the worktable. For these reasons, one or more flat machined or planed reference surfaces for positioning and mounting are highly recommended.

Fig. 7. Pattern is removed after final mix has set by wedging evenly around the surface or by careful use of compressed air.

Summary

The use of gypsum cement for die sinking patterns in the automotive and aircraft forging industries has facilitated this phase of tooling to such a degree that it is now considered an essential tooling medium. Coupled with the fact that the gypsum cements are being used to meet the rigid tolerances of the Air Force heavy forging program, these materials are under continued development to keep pace with technological advancements in the aircraft industry. Compared with metal or wood die sinking patterns, the gypsum cement patterns afford advantages such as: (1) saving of ⅓ to ½ in pattern making time; (2) accuracy and stability of dimensions; (3) adaptability to complex contours and shapes; (4) reproduction or duplication of existing patterns and models; (5) quick and easy modification; (6) comparatively small investment in tools and shop equipment.

Keep Cool

CONSIDERING industry set fire to itself 35,700 times last year (with losses varying up to the fantastic $55,000,000 suffered by GM in its Livonia, Mich. plant), manufacturers may well pay obedient heed to a simple set of rules outlined by The National Fire Protection Assn.

The Association cautioned: Prevent trash from collecting under benches, and in closets, elevator pits or other enclosed places; keep stock piles low enough that they could not block the spray of water from sprinklers in case of fire; keep fire doors closed, unobstructed, clearly marked, and don't tamper with automatic weights; keep combustibles or materials in combustible packaging at a safe distance from welding jobs.

powder metal parts CAN COST LESS

By Robert O. Borden

Manager, Erie Factory
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MANUFACTURE of alloy bushings and other parts by sintering was found by one company to be faster than machining from bar stock and resulted in other desirable savings. Production of machined brass bushings for gas meters averaged 230 pieces per hour with up to 50 percent being rejected. By making the same parts, *Fig.* 1, of sintered powder metal, the company has increased hourly output to 4000 for some parts and reduced scrap greatly.

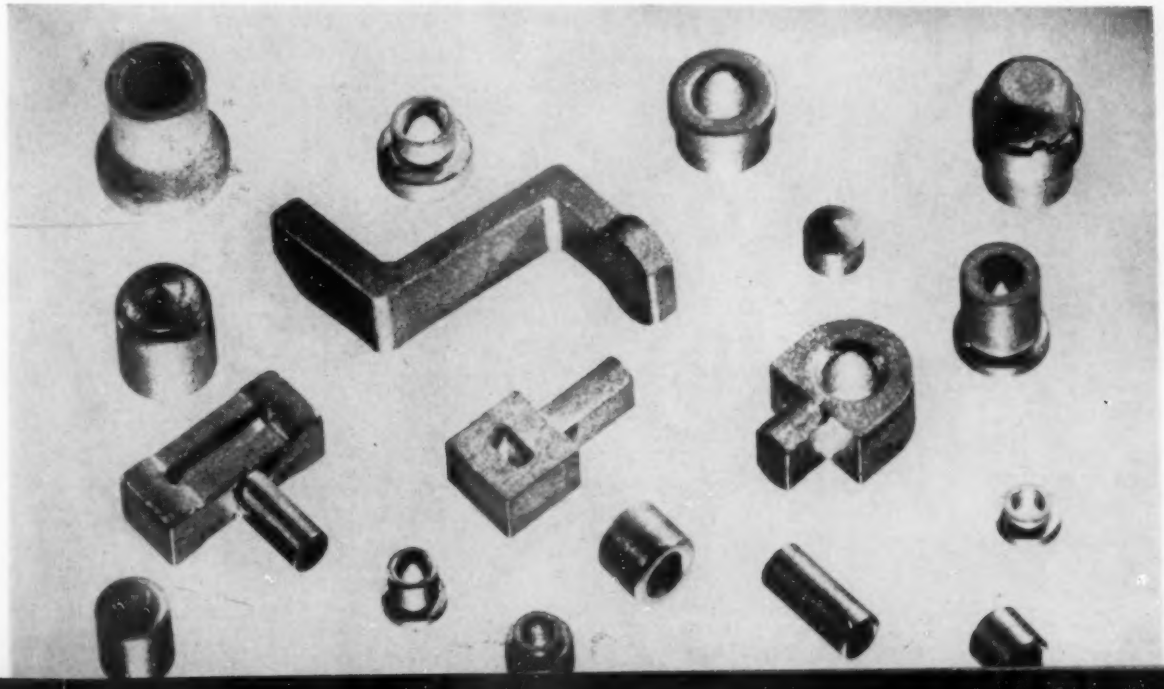
Sintering was not adopted until tests were made of various powder metal alloys to find the most suitable mixture. The resultant choice is a bronze alloy that consists of about 90 percent copper and 10 percent tin. When the sintered bushings are impregnated with oil, friction loss is low, a prerequisite for bushings used in meters.

Mixing drums, furnace, sizing presses, oil impregnating equipment, atmosphere generator and other sintering facilities are enclosed in a separate part of the shop, *Fig.* 2. Furnace and generator, manufactured by Surface Combustion Corp., are centrally located in the area to facilitate work flow.

Sintering Operations

Mixing: Metal powders are accurately weighed and then mixed in tumbling drums. Zinc stearate is added to the mixture for lubrication during briquetting. Each drum contains a free-turning cylindrical screen that is removed after 10 minutes. The

Fig. 1. Sintered precision bushings and parts for a gas meter. Production was increased and costs lowered by changing from machining to sintering.



mixture is agitated under drying lamps for one hour homogeneity and thorough drying.

Compacting: Briquettes are formed by matching dies in a 4-ton mechanical press that is fed automatically from a hopper. Hourly output and the amount of powder required varies according to depth and diameter of the part. Several dies are producing acceptable parts after compacting 1½ million briquettes.

Sintering: Depending on size, 700 to 1500 parts are placed in one layer on stainless steel trays that are pushed through a muffle furnace, *Fig.* 3, gas-fired at 1550 F. The furnace charge vestibule holds two trays while four trays are stationed in the heating chamber and four are in the cooling area. A counting device on the briquetting press insures accurate loading of each tray. Trays weigh from 1 to 13 lb per 1000 parts. Bushings are cooled in a water-jacketed chamber at the discharge end of the furnace. Time for the sintering cycle is 50 minutes and parts can be freely handled at the end of the cold zone. After pushing in a loaded tray, the operator resets a 5-minute timer and proceeds to the discharge end where he withdraws the last tray. When the timer bell sounds, the operator repeats his movements.

Because certain alloy powders expand when heated and because oxidation would prevent fusion, temperature and atmosphere should be uniform and closely controlled. Automatic proportioning burners, firing over and under the alloy muffle, maintain a constant temperature with a high degree of accuracy. The atmosphere generator delivers 150 cfh of dissassociated ammonia vapor (H_2, 75 percent; N, 25 percent) at 1750 F. This special atmosphere effectively prevents oxidation of a variety of metals under various conditions.

Sizing: Sizing operations are performed in a 4-ton mechanical press similar to the briquetting press. Sizing strengthens the part and overcomes the expansion resulting from heating at near melting temperatures. Compensations made during part design minimize the amount of these dimensional changes and insure accuracy.

After sizing, bushings are placed in pans containing special impregnating oil. Parts are heated in the oil at 170 F for 2 to 3 hours and drained for one hour. Oil-hydraulic and mechanical presses are used to assemble finished bushings in various parts of the gas meters.

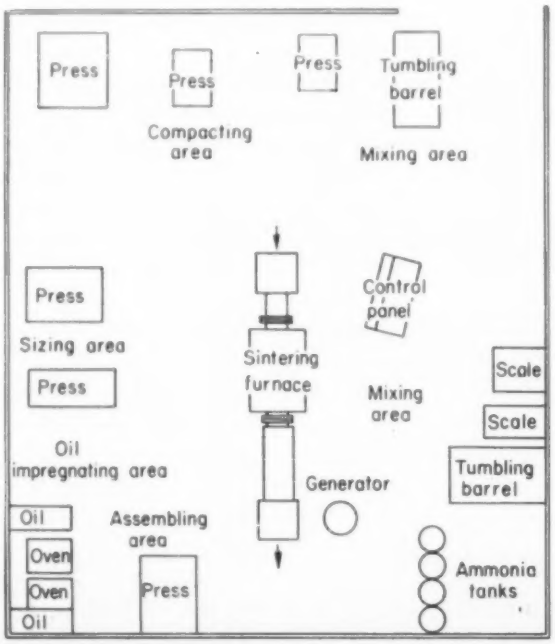
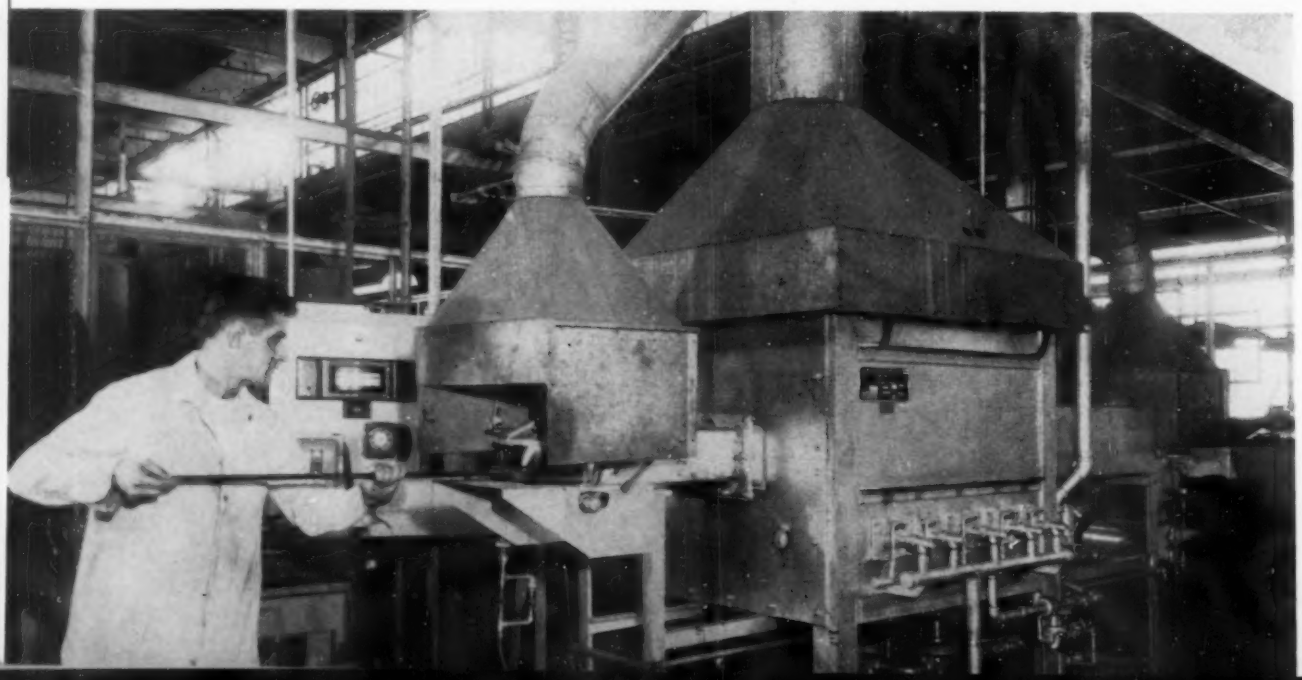


Fig. 2. (left) Floor plan of sintering area with furnace in center and other equipment in proper position for production sequence.

Fig. 3. (below) View of muffle furnace with cooling chamber. Operator is pushing a tray loaded with briquettes into the charge vestibule.



electric controls

Part 4 — D-C Motor Control

By John C. Ponstingl

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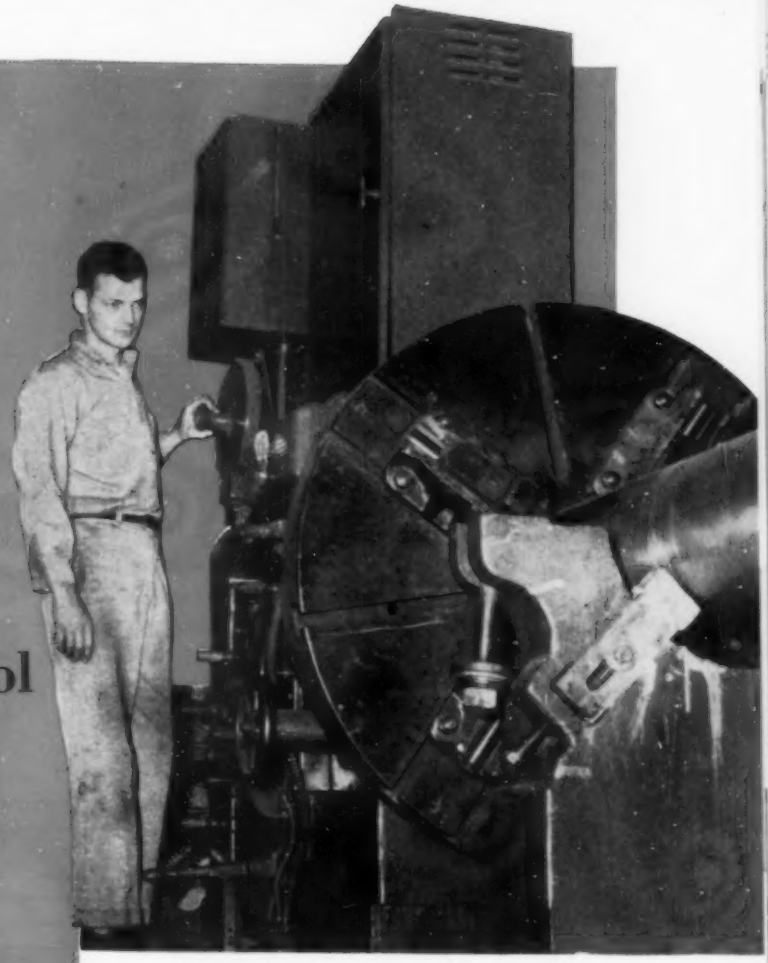


Fig. 1. Speed of large lathes is easily controlled with a d-c motor and a field rheostat.

CONTROLS for constant-voltage direct-current motors are important to the tool engineer because many machines use d-c drives. Also, this information is useful in applying adjustable-voltage drives which use d-c motors and an a-c power supply. Direct-current motors and controls are useful for two reasons: (1) if only d-c constant-voltage power is available or (2) if the characteristics of the d-c motor are desirable. These include speed control, dynamic braking and high breakaway torque. The fact that these motors can provide smooth, stepless speed control, *Fig.* 1, has made the use of a-c to d-c conversion desirable to enable using the motor on a-c power systems.

The functions of any control depend entirely on the characteristics of the motor and the performance desired. The usual functions of these controllers are summarized in TABLE 1.

In reviewing the motor characteristics it should be noted that any d-c motor can be classified under one of three groups: series, shunt or compound motor. With the main field designed for connection in series with the armature winding, a series motor produces a very high starting torque but operates at a speed which varies inversely with the load. This motor is particularly applicable to cranes as shown in *Fig.* 2, by automatically speeding up as the load decreases and slowing down as the load increases to deliver higher torque.

When the main field winding is designed for connection in parallel with the armature, the machine is a shunt motor. It produces a normal starting torque and operates at relatively constant speed, not varying appreciably even under wide fluctuations of load. This characteristic makes the shunt motor particularly suited for drives where constant speed is essential.

The speed-torque characteristics of the series and shunt motors may be combined to get any degree of speed regulation desired. This combination is called a compound wound motor. The shunt field is in parallel with the armature and the series field. Compound motors have mixed characteristics determined by whether the predominating field is

shunt or series. When the shunt field predominates, the function of the series field is to increase torque somewhat but it also has the effect of decreasing the full-load speed. When the series field predominates, the shunt field prevents excessive speed under light load.

In an a-c motor, the rotor current is induced by transformer action from the stator winding. Since no transformer action is possible from steady-state d-c field windings, the current must be introduced into the rotor or armature windings by means of brushes and a commutator. The coils of the windings are progressively energized as they are oriented with respect to the field poles to produce the desired rotating torque. As with any switch, there is a limit to the amount of current that can be interrupted as each segment moves away from the brush. The word "commutate" describes this current interrupting ability of the commutator segments and brushes. Motors are available that can commutate as high as 500 percent of the full-load current rating of the motor. In most cases, however, 250 to 275 percent is a safer value.

Motor Starting

Switches to connect the motor to the power supply can be a set of manually operated contacts such as on a drum switch or magnetically operated contacts. Also, some type of overload relay is employed to give motor running overload protection. *Fig.* 3 shows a schematic diagram for this type of starting which is essentially a d-c linestarter.

When a-c motors are linestarted, the inrush currents may be as high as 10 times the full-load current rating of the motor. The same things is true for d-c motors. Because direct-current motors have commutators that might be damaged by excessive starting currents, full-voltage starting is not always permissible, except for small motors that have relatively high internal resistance in the windings.

D-c motors up to 2 hp can usually be linestarted. A system characteristic which can be taken

Table 1—Control Features for D-C Motors

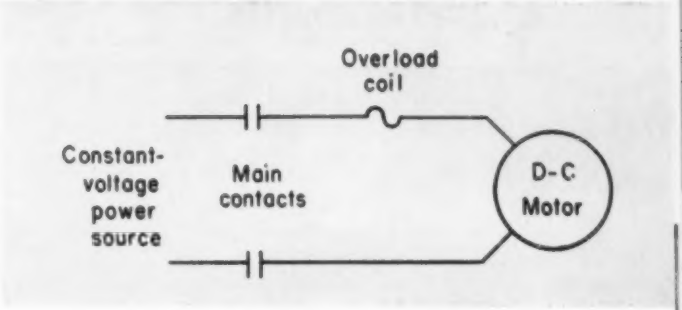
Feature	Purpose	Cost Index* 2 HP	Cost Index* 10 HP
Manual linestarter	Connect motor to line and provide overload protection.	1	—
Magnetic linestarter	Connect motor to line and provide overload protection.	2	—
Magnetic reduced-voltage starter	Connect motor to line with series resistance to limit starting current and provide overload protection.	2	4
Magnetic reduced-voltage starter	Connect motor to line with series resistance to limit starting current and provide overload protection.	4 to 8	8 to 10
Manual speed control by armature resistance	Reduce armature voltage with series resistance	1.5	3
Magnetic speed control by armature resistance	Reduce armature voltage with series resistance		20
Speed control by field control	Insert resistance in series with motor field.	1	1 to 2
Armature shunt	Insert resistance in parallel with motor armature to provide creeping speeds.		2
Dynamic braking	Insert resistance in parallel with motor. Motor acts as generator feeding power into resistor for quick braking action.	2	2
Reversing (magnetic)	Reverse polarity to motor armature to reverse rotation of motor.	2	6 to 10
Field accelerating relay (also full field)	Short out field rheostat to insure maximum motor torque with minimum armature amperage during acceleration.	—	3.5
Field decelerating relay	Short out field rheostat to insure maximum motor torque with minimum armature amperage during acceleration.	—	3.5
Field failure (loss) relay	Shut down motor if shunt field is accidentally de-energized to prevent runaway motor.	—	3
Field protective (economizer) relay	Keep motor field from overheating while motor is not rotating and field is energized.	—	3.5

*Approximate relative cost compared with a manual linestarter.

—Photo courtesy Euclid Crane Co.

Fig. 2. (above) Machine shop crane is conveniently controlled by using d-c motors and armature speed resistors.

Fig. 3. (right) Typical schematic diagram for d-c linestarter.



into consideration and which may permit linestarting d-c motors up to 7½ hp is the internal resistance (or regulation) of the power source plus the resistance of the conductors leading to the motor. Actually, a d-c motor can commutate more current at low speeds than at high speeds. With the armature practically standing still, most commutators can handle currents as high as 6 to 8 times the full load rating of the motor without sparking. As the motors become larger, a starting or current-limiting resistor must be added to limit the starting current. In a manual face-plate type of starter, as shown in *Fig* 4, the resistance is gradually shorted out as the motor accelerates. The motor's counter emf (electromotive force) increases with speed, reducing the current so that, when the motor reaches speed, all the starting resistance is shorted out and the motor draws its normal running current.

In a magnetic type starter, the resistance can be shorted out in one or several steps, depending on the size of the motor and the smoothness of acceleration desired. *Fig.* 5 shows what would happen if the resistance were shorted out too soon. The second inrush would be worse than the starting current. Furthermore, the ability of the commutator to handle current decreases as the armature speed increases. Experience has shown that the minimum number of points of acceleration for standard d-c motors is about as shown in TABLE 2. Most commercially available d-c starters conform to this arrangement. The motor acceleration may have to be modified from standard if:

1. The driven load cannot accept the torque peaks developed by the resistance steps.
2. More steps of acceleration are necessary to provide smoother acceleration.
3. The inertia of the driven load is so high as to produce a long accelerating time. Standard resistors normally are of the NEMA 130 series based on 10 seconds on out of each 80 seconds. For longer accelerating periods, resistors with more thermal capacity must be used.

Whether motor acceleration is performed manually or magnetically depends on the size of the motor under control. Manually operated starting rheostats (Faceplate-type for armature circuit) are available to control motors up to approximately 150 hp, 230 volts. Drum-type controllers, in combination with separate resistors are available for motors up to approximately 50 hp. The full-load current of a 50-hp, 230-volt motor is approximately 180 amperes. Because of the physical size of the contacts to handle this magnitude of d-c current, it is desirable to use magnetic contactors. Many times, when manually controlled acceleration (speed control) is desired, magnetic contactors are employed to handle the power circuits and a small master switch (manually operated) is used to control the contactors.

The degree of automation needed in an application also determines whether acceleration is manual or automatic. When the control and acceleration of a motor are removed from the discretion of an operator, the mechanical operation of the contacts (closing and opening the d-c circuits) must be performed by some means such as:

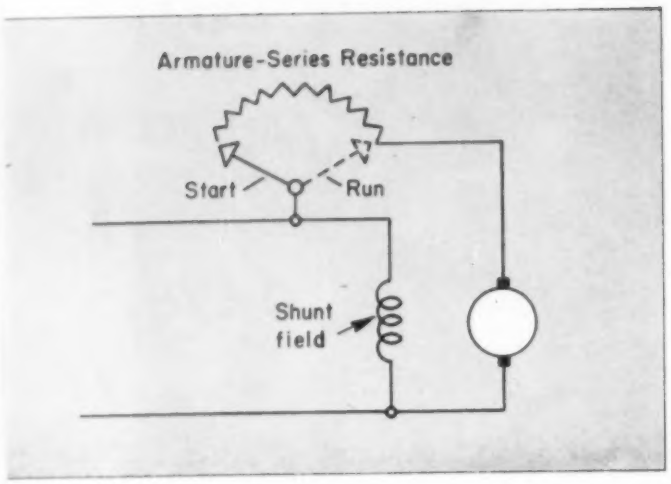


Fig. 4. Simple motor starting circuit using a manually operated resistor face plate.

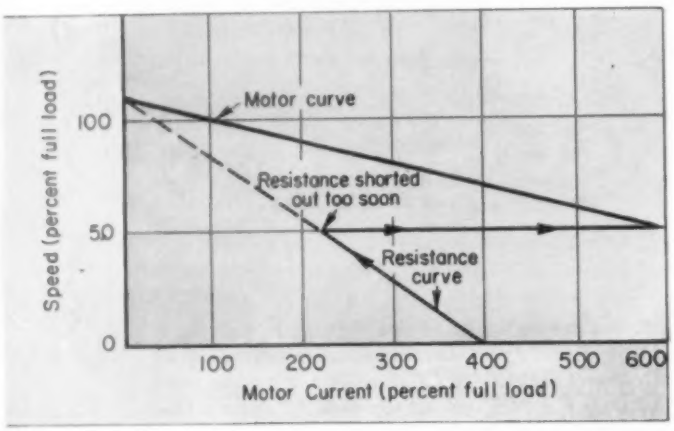


Fig. 5. Speed-torque curve showing high peak developed when starting resistance is shorted too soon.

1. Magnets (magnetic contactors)
2. Motors (motor-operated rheostats)
3. Fluid (pneumatic contactors used mostly in traction control).

In the process of motor acceleration with magnetic contactors some form of intelligence must be used to initiate the shorting-out of the starting or accelerating resistor, be it in one step or many steps.

The proper time for shorting out a starting resistance step is when the motor has accelerated to a speed where removal of the resistance step will not impose too high a current peak. The three most common methods of determining the right speed to short out resistance are by measuring speed, current or time.

Speed Acceleration: Actually the coil of a magnetic contactor can be connected across the armature of the motor which will cause the contactor to close at, say 75 per cent of line voltage. When the motor accelerates to the point that the motor counter emf is approximately 75 percent of line voltage (the counter emf of a standard shunt motor is 90 percent of line voltage when running at full load—10 percent regulation), then the magnetic contactor automatically closes to short out the resistor. This system has the advantage of being simple, and is used on inexpensive controls for blowers, small machine tools, and compressors where the type of starting load is consistent. Should the motor fail to accelerate to the necessary speed (e.g., an abnormal load condition of 200 percent) the motor would never develop more counter emf than 58 percent of line voltage and consequently would never short out the resistor. Unless the resistor were rated for continuous service it would burn out.

Current-Limit Acceleration: This method is often used for heavy inertia loads such as centrifugal-casting machines which require longer than normal time to accelerate (2 to 15 seconds is considered normal starting time). Heavier starting resistors may be required because of the longer accelerating time. In this case, the motor current would be measured. When it reduces to a suitable value (say 125 percent of full load), a current sentitive relay would initiate the accelerating magnetic contactor. The starting load must be consistent, however, because motor current must reduce to 125 percent in order to short out the resistance.

Time-Limit Acceleration: This is probably the most-used system. Time-limit acceleration brings the motor to speed in a definite time regardless of load. Standard adjustable timing may vary from ½ to 3 seconds per step when NEMA 130 or short-time resistors are used. If the timing is increased to, say 4 to 6 seconds, a heavier duty (NEMA 140) series resistor must be used.

Speed Control

Because speed control of d-c motors is more flexible than that of a-c motors, d-c motors are used extensively in production machines, *Fig.* 6. Basic speed-torque characteristics for series and shunt motors are shown in *Fig.* 7. Compound-wound motor speed characteristics vary between these characteristics depending on the proportion of series and shunt fields used.

Armature-Series Resistance: Armature-series resistance with the series or shunt motor produces various motor speeds below the base speed of the motor. In the series motor, *Fig.* 7 *a*, the field-winding current is also affected by the armature-series resistance, producing a greater effect on its speed-torque curve than for the shunt motor, *Fig.* 7 *b*, where the field current remains constant.

Series motors with armature-resistance control (sometimes called rheostatic control) are com-

Table 2—Accelerating Steps on Standard D-C Starters

Horsepower	Voltage	Accelerating Points (No.)	Starter Type
1.5	115	1	Linestart
2	230	1	Linestart
3	115	2	1-step resistance
5	230-550	2	1-step resistance
10	115	3	2-step resistance
25	230-550	3	2-step resistance
20	115	4	3-step resistance
40	230-550	4	3-step resistance
75	115	5	4-step resistance
150	230-550	5	4-step resistance

monly used for d-c cranes, *Fig.* 2, and for battery-powered fork trucks as shown in *Fig.* 8. Resistors are simply connected in series with the motor and shorted out in steps manually by means of a drum controller or magnetically by means of magnetic contactors and a pilot switch or pushbuttons. The more resistance in the circuit, the lower the motor speed.

As shown in the speed-torque curves, every change in load is accompanied by a change in armature voltage. Speed control of d-c motors by armature-series resistance compares closely both physically and costwise with speed control of a-c wound-rotor motors using secondary resistors. Speed control by this method is usually limited to approximately 50 percent.

Armature-Shunt Resistance: This method of speed control can be added to a shunt or a series motor, *Fig.* 7 *c* and *d*, to give light-load speeds down to 10 percent. It slows the d-c motor to creeping speed by diverting a large portion of the line-current around the armature. By means of the series resistance, voltage on the motor armature is reduced, keeping the speed low.

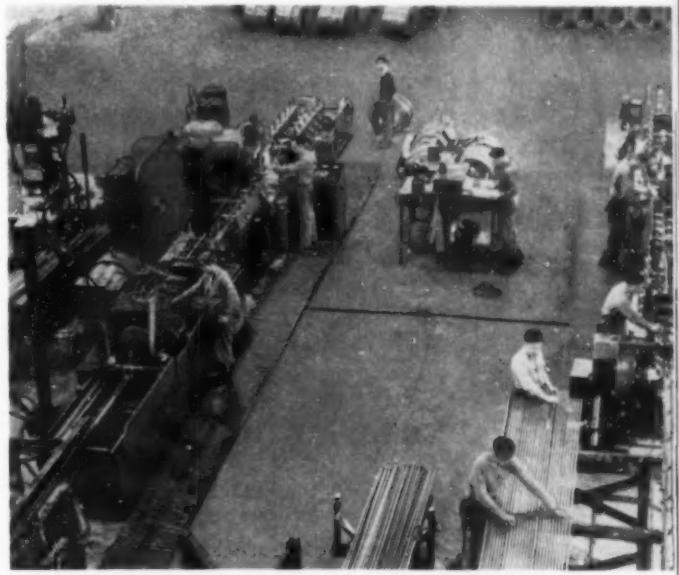
Series-Parallel Combinations: An effective method of reducing the armature voltage and resulting motor speeds is to connect two identical motors in parallel or series as shown in *Figs.* 7 *e* and *f*. When the motors are in parallel, full voltage is across each motor, causing the motors to run at base speed. When the motors are in series (in the case of the series motors) or the motor-armatures only (in the case of the shunt motors), the motor speeds are essentially one-half of base speed. Traction equipment using two motors sometimes employes this scheme.

Field-Series Resistance: Fixed or rheostatic resistance in series with the field of a shunt motor provides speed adjustments up to four times base speed, *Fig.* 7 *g*. Speed ranges as high as 8 to 1 can be obtained with special motors. Throughout the range above base speed, good speed regulation is obtained. Since the field strength is weakened to produce the higher motor speeds above base, the rated motor torque reduces so that in effect the horsepower output does not increase above base speed, but remains constant.

Normally, series motors are operated at base speeds and speeds below base. However, with the addition of a series-field shunt resistor, it is possible to weaken the flux and increase the motor speed.

Motor Braking

A d-c constant-voltage drive is adaptable to quick stopping. In the case of a shunt or compound motor, all that need be added to the basic control is one normally-closed contact added to the contactor for a dynamic braking resistor. During braking, the motor field is kept excited and the motor acts as a generator whose energy is absorbed in the braking resistor. This system is commonly used on crane hoists to provide braking action when lowering overhauling loads.

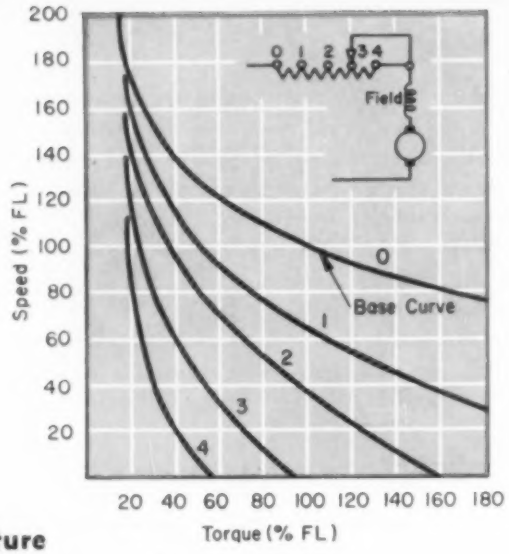


—Photo courtesy Yoder Co.

Fig. 6. Tube mills employing d-c drive motors with a constant-voltage source. Field rheostats provide convenient speed control.

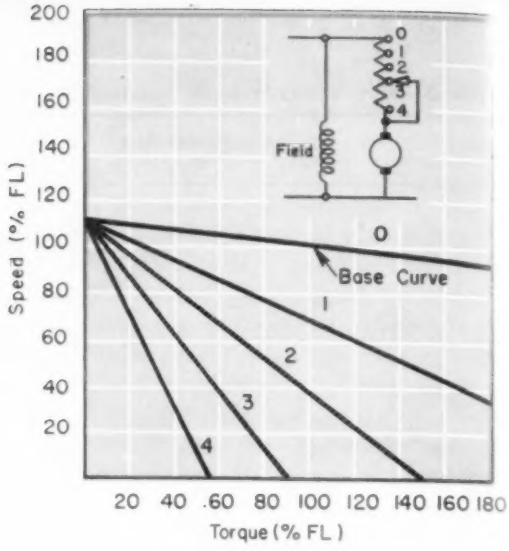
Another common system is plug stopping. For plug stopping the d-c drive needs a reversing controller with a plugging resistor to limit the current to a safe value plus an auxiliary contactor and control relay to short out the resistor during the running operation. Plug stopping, as well as dynamic braking, is used on fork trucks, machine tools and bridge and trolley motions on cranes.

Regenerative braking is useful for braking the motor against increased speeds caused by over-

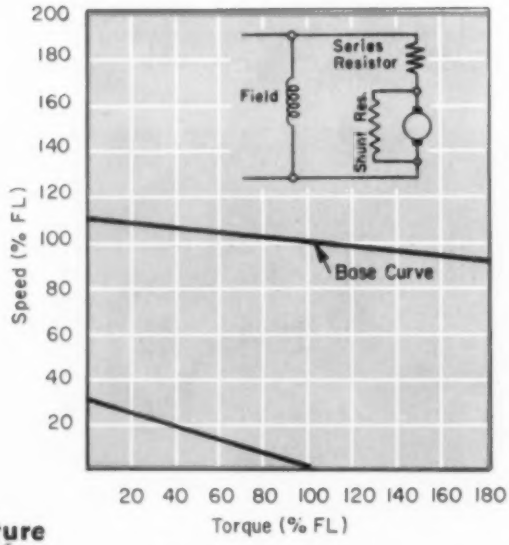


Armature Series Resistance

(a) Series Motor

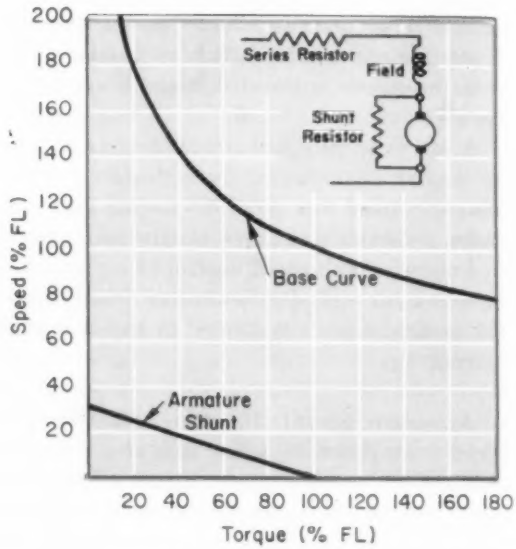


(b) Shunt Motor

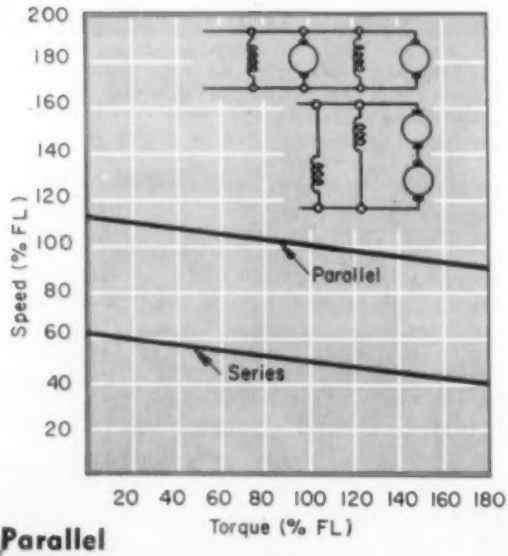


Armature Shunt Resistance

(c) Shunt Motor

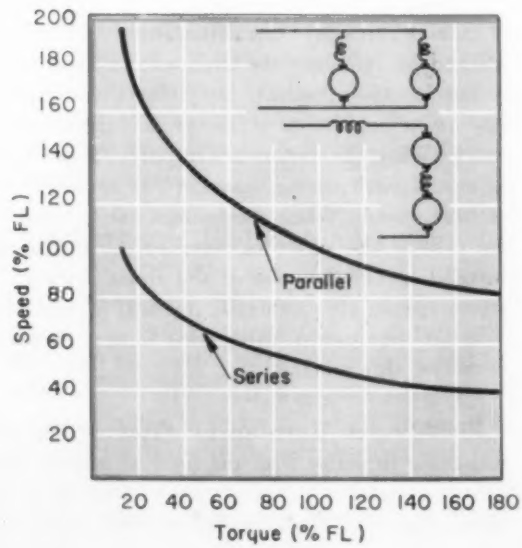


(d) Series Motor



Series-Parallel Combination

(e) Shunt Motors



(f) Series Motors

hauling loads. Driving the motor faster than it would normally run provides the braking effort by actually generating power and feeding it into the power system. Shoe or disk-type braking is often used, having the advantage of not adding heat to the motor. This also provides a holding action at standstill.

Motor Protection

In general, motor running over current protection is similar to that used on a-c motors. Because of the inherent sensitivity of the commutator and brush system (limiting maximum motor currents) on d-c motors, instantaneous types of motor overcurrent protection are often used, in addition to the inverse time type that normally simulate motor-heating conditions. Forms of instantaneous overcurrent protection include:

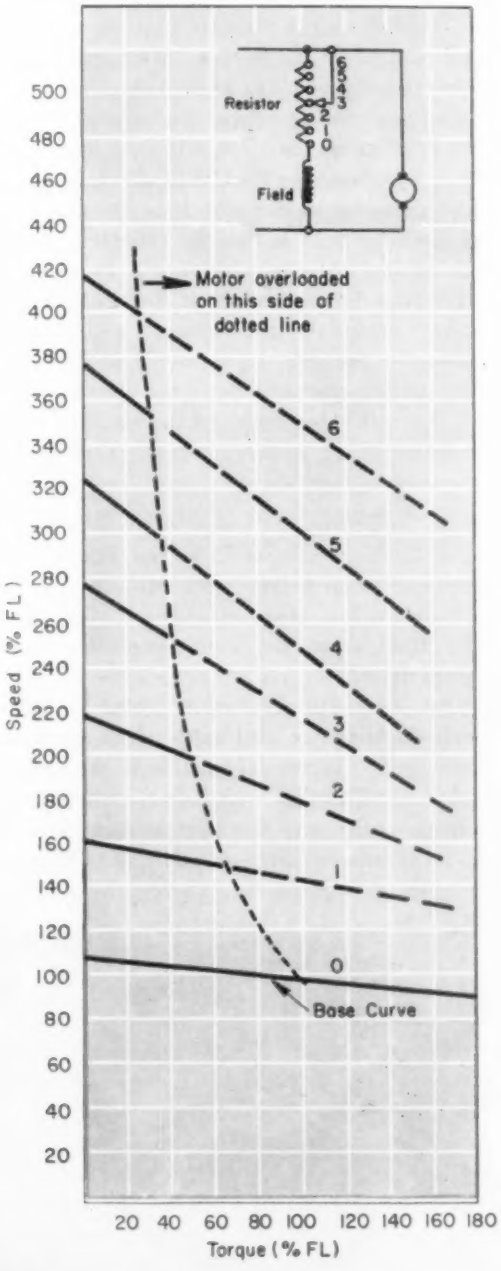
1. Plugging Relay: Used extensively on cranes to insure immediate starting in reverse direction with sufficient resistance (plugging resistor) to limit the inrush current.
2. Antiplugging Relay: Used with d-c reversing controller to prevent plugging on machines with flywheels or high inertia mechanisms. Without a series plugging resistor in the motor armature circuit, the motor may be damaged by commutator flashing.
3. Instantaneous Overcurrent Relay (overload): Used to prevent excessive motor currents due to an unforeseen overload. When the overload relay operates, the motor is immediately disconnected from the line.
4. Jamming Relay: Operates similar to the instantaneous relay, except it is used where it is not desirable to disconnect the motor but maintain some limited torque on the motor. When a severe overload occurs, the jamming relay operates to initiate the insertion of a resistor in series with the motor armature to limit the motor current to safe value.

A field-loss relay should be applied without fail to every shunt motor whenever accidental loss of field would cause the motor to run away. The relay has its coil connected in series with the shunt field and its contacts in the stop circuit. If the field fails, the relay opens, stopping the motor.

A field accelerating relay prevents excessive armature current from damaging the commutator. It is always used where the motor speed is varied more than 2 to 1 by field control. The relay operates to limit the armature current during starting and during sudden speed increases, resulting from change of the field rheostat. As soon as armature current gets too high for safety, this relay picks up and the field rheostat is shunted out. As a result of this action, full field is applied to the motor and the armature current drops. This, in turn, causes the accelerating relay to drop out, and the field rheostat to cut back in. So, once more armature current increases and once more the cycle of action occurs. Repetition of the cycle causes the relay to flutter back and forth rapidly, until the motor accelerates to a speed where armature current is normal.

A field-decelerating relay functions (similar to the field accelerating relay) to prevent possible commutator damage when a d-c motor is suddenly decelerated through a speed range of 2 to 1, or greater. Without this relay, a powerful regenerative voltage and current would be induced in the armature and possibly cause the commutator to flash over. The instant the armature current approaches a dangerous

Fig. 7. (left and below) Speed-control systems used with d-c motors on constant-voltage power supplies.



Field-Series Resistance

(g) Shunt Motor

—Courtesy Baker Raulang Co.

Fig. 8. Battery-operated fork truck employs constant voltage d-c motors using armature resistance for speed control.

value, this relay reinserts field resistance, causing the regenerative current to drop. As current drops, the decelerating relay removes the resistance. This protective cycle continues until the motor has slowed.

A full-field relay should be applied when the field control employed is preset and when the motor is started from rest with some resistance in the field circuit. Under such conditions, a full-field relay is needed to obtain maximum starting torque for accelerating to full load. To that end, during the armature acceleration period the full-field relay shunts out the field rheostat.

A field protective relay, often called the field economizing relay, is used to prevent overheating of an intermittent-duty shunt field when the motor stands idle with the field energized. This applies to reversing starters and starters featuring dynamic braking. The relay inserts resistance in series with the shunt field whenever the motor is not running. In this way, the power loss in the field is reduced when the motor is standing idle; it also protects the field from burning out since the normal cooling windage (when motor rotates) is absent.

Field-discharge resistors play an important part in motor-field protection. When the shunt field circuit is opened, the high inductance of the field windings tends to oppose the opening of the circuit by building up the voltage to keep the current flowing. Since opening the circuit abruptly may damage the insulation of the field, it is advisable to supply a discharge path so that the generated voltage may be limited to a safe value. In the case of non-reversing d-c controllers, if the shunt field is connected behind the line contactor, a discharge path is provided through the armature of the motor and the starting resistance when the circuit is opened.

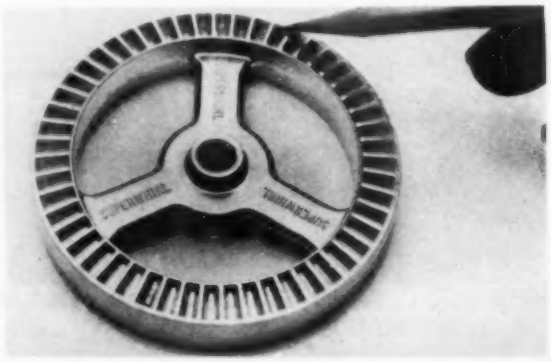
This article has reviewed the fundamental characteristics of d-c motor controls. Various forms of these same controls are equally applicable to adjustable-voltage drives which will be discussed in a later article in this series.

Production Improvement through Redesign

REVIEW OF A DESIGN and the resultant small change solved a production problem for Turner & Seymour Mfg. Co. The product is an egg beater made with three zinc die castings—main frame, crank and driving gear. The gear was the problem piece. For wear and appearance, die castings are chrome plated; but since the cast gears had surface blemishes, extra time was needed in plating and polishing them—pushing production costs up.

Engineers of the Precision Castings Co., to whom the problem was taken, pointed out that the shroud encircling the gear (illustrated) was unnecessarily thin; this undoubtedly was responsible for the pinholes, porosity, heat marks and cold shot. Zinc alloy apparently solidified before penetrating into the thin outer rim, and prevented its filling properly.

By designing dies which would increase the wall thickness, as well as the draft at the ends of gear teeth, a successful solution to the problem was achieved. Together with better venting and gating practices, the new dies permitted production rates to be effectively increased and rejects were reduced.



damping boring bar vibrations

VIBRATION is one of the greatest causes of inaccuracy in precision boring operations. Vibration in boring bars can be self-induced, transmitted from the machine on which the boring is done or transmitted from other machines. Self-induced vibration results from the cyclic changes in load on the tool caused by breaking of the chip. These vibrations can be magnified by dull tools or excessive overhang. Transmitted vibrations are usually of different frequencies and can be eliminated only by finding the sources and isolating them.

According to engineers of the Carboloy Dept., General Electric Co., Detroit, Mich., something can be done about self-induced vibrations to improve the finish produced and lengthen tool life. The method consists of inserting a vibration damper in the boring bar and is equally applicable to rotating or stationary bars. With such dampers, bars of larger length-to-diameter ratios can be used with satisfactory results.

The damper consists of a piece of high tungsten alloy (Hevimet) that "floats" in a cavity located as near the free end of the bar as possible. The cavity and slug are accurately finished so that the slug will be supported by an air film. Inertia of the slug, which is not attached to the bar, damps out the vibration of the bar.

To meet conditions imposed when boring through and blind holes, two methods of placing the slug are required. It is easiest and best to position the slug in front of the tool, *Fig.* 1, but this can be done only for bars that are used in through holes. A hole is drilled and ground in the end of the boring bar, the ground slug is inserted and a cap brazed on.

When boring a blind hole, a cartridge arrangement must be used. In this method, the slug is positioned behind the tool, *Fig.* 2. The cartridge containing the tool is then brazed to the tool and serves as a cap over the slug cavity.

In both methods, the slug should be as large in diameter as the bar will allow. For example, a ¾-inch diameter slug would be used in a 1-inch diameter bar. The ratio of slug diameter to length should be 1:2, or a ¾-inch diameter slug should be 1½ inches long. Both the slug and the hole should be ground, with an air space of 0.003 inch for diametrical and 0.010 inch for longitudinal float.

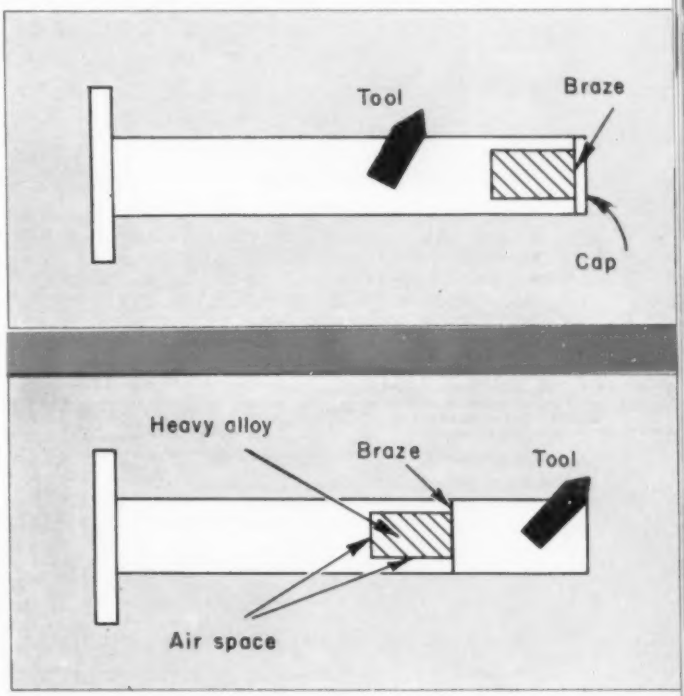


Fig. 1. (upper) When boring through-holes, the heavy metal slug is contained in a cavity at the free end of the boring bar.

Fig. 2. (lower) Cutting tool is mounted in a cartridge ahead of the slug cavity when the boring bar is used for blind holes.

designed for PRODUCTION

Air Powered Hand Grinder Adapted for Wood Gouging

HAND GRINDER TOOL is powered by a 1700-rpm air motor. An exhaust duct from the motor blows shavings away from the spinning blade and keeps the working head cool. A metal guard is placed over the trigger so the grinder will not be started accidentally by laying it down. A hand guide mounted at right angles to the shaft gives the worker a firm hold on the tool while chipping away the wood.

The need for a tool to gouge wood arose when Chance Vought Aircraft's experimental model shop was called on to carve six big propeller blades out of 9-foot slabs of laminated Sitka spruce for use in a low-speed wind tunnel at Dallas, Tex. Large quantities of wood had to be removed to make curved surfaces with close tolerances.

Replacement of the wheel by a cutting tool in an ordinary grinder, which had to be held parallel to the wood surface, did not do the job, so a new tool was devised that could be held at a 20-deg angle. A special fluted cutter with six blades was manufactured with curved cutting edges to permit gouging without leaving the sharp edge characteristic of a milling cutter or chisel. The tool enables woodworkers to do a faster, smoother job of cutting with less noise than a chisel.

Multiple Spindles Multiply Output

Though not new or revolutionary, the use of multiple-spindle or cluster heads for performing a number of simultaneous precision finishing operations on a single workpiece plays a vital role in today's trend toward more automatic production. Many parts, because of their size, shape or number of work surfaces, do not lend themselves to transfer machine setups or other automated work handling devices. In these instances, multiple spindles can lower costs, raise quality standards and increase output for long production runs.

There are various methods of grouping spindles to obtain a given boring pattern but center distances determine the method best suited for the job. Engineers of The Heald Machine Co., Worcester, Mass., have outlined these methods and the factors that determine when each should be used.

Wherever center distances permit and spindle height above bridge is not too great, standard permanently lubricated boringheads should be used for simplicity and over-all versatility. This method of obtaining a multiple-spindle pattern means that

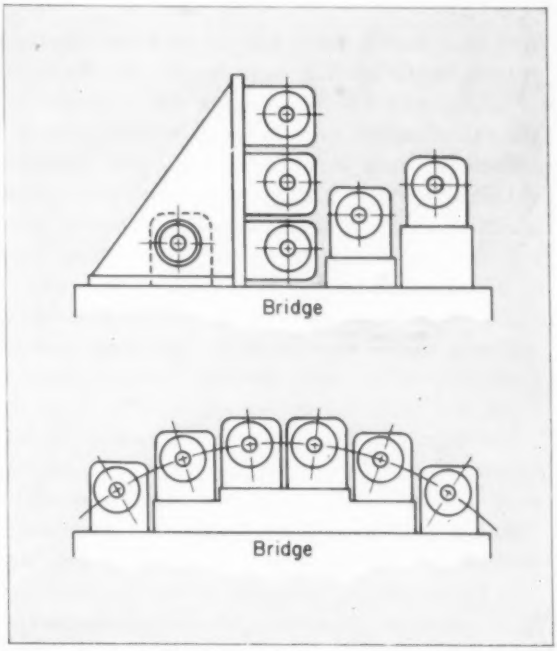
all components of the machine are standard with the exception of special raising blocks, angle plate mounting brackets and fixtures.

Where unusually close center distances or exceptional height of spindles above the bridge make it impossible to use standard boringheads, tailor-made multiple-spindle head units, or cluster heads, must be used. Cluster heads, wherein a single cast or fabricated head body houses multiple spindles, fall into three categories.

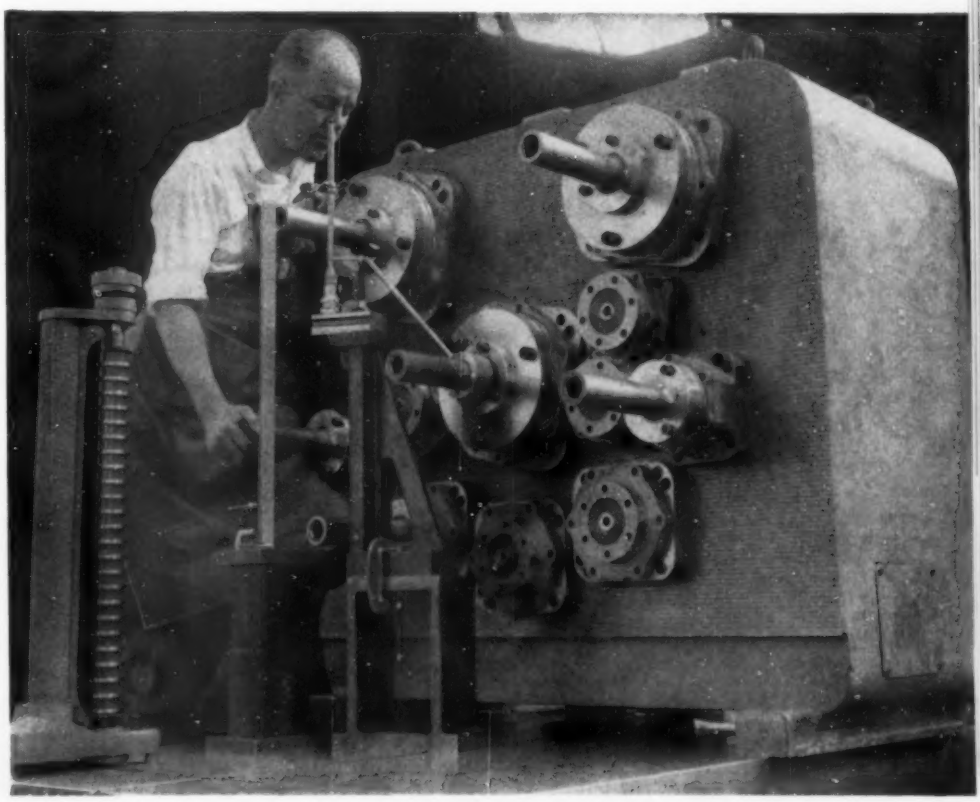
Individual belt-driven cartridge spindles represent the preferable unit for cluster head design. Head bodies are bored slightly larger than the cartridge OD permitting final adjustment of the spindles for accurate relative location. Once this location has been obtained, both cartridge flanges are doweled to the body.

The photographs on this and the next page illustrate two views of a cluster head in which individual belt-driven cartridge spindles are correctly applied for a boring operation.

Individual belt-driven spindles without the surrounding cartridges permit closer center distances without sacrificing spindle rigidity. This approach requires extreme accuracy of location because the head itself seats the spindle bearing outer races without provision for adjustment. Further reduc-



STANDARD BORINGHEADS can be combined in many ways through the use of special raising blocks, mounting brackets and fixtures. Such combinations are most easily changed to meet requirements of design changes.



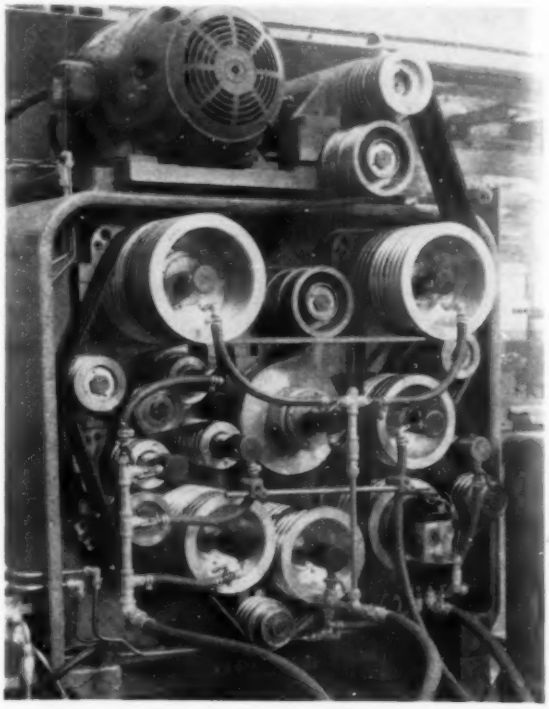
CLUSTER HEADS made up of individual belt-driven cartridge spindles represent proper cluster design because individual heads can be adjusted for accurate location during setup. Inspector is checking units prior to doweling cartridge flanges to the head body.

tion of center distances may be obtained by grinding the inner bearing races on the spindle itself.

Where extremely close center distances prohibit the use of individual belt-driven spindles, a single belt-driven head may be used to drive multiple spindles through gears. Here again, accuracy from start to finish is of utmost importance because once spindles are located, they cannot be adjusted.

It may often prove advantageous to combine a small cluster head and one or more standard boringheads rather than fabricate one large cluster. Such setups are sometimes used to simultaneously finish more than one workpiece.

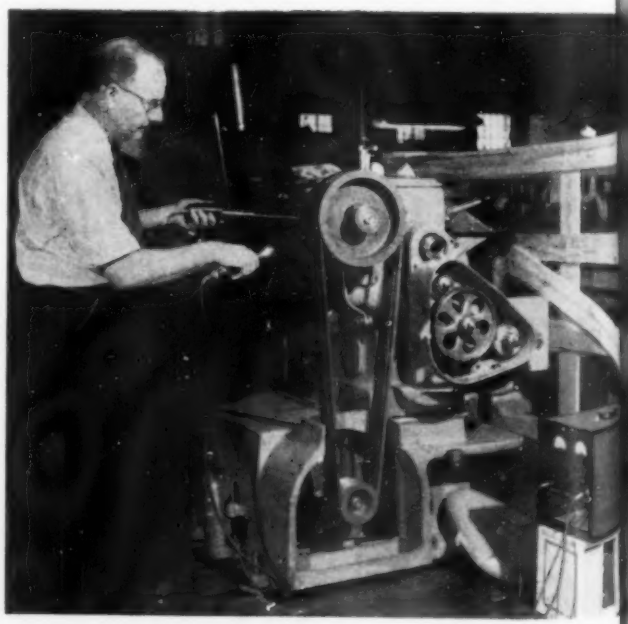
Multiple spindle machines are advantageous because accurate and continued duplication of the work pattern is assured once the spindles have been proved for correct relative location. Simultaneous multiple boring operations speed production not only by performing a number of operations on the same part at the same time but also by eliminating the handling time which would be required between operations if separate machines were used. Multiple spindle machines reduce floor space requirements by using one machine to do the work of several and by reducing between-machines work storage. Automatic cycles of multispindle boring machines limit the possibility of human error and require a minimum of operator attention.



COMPLICATED BELTING arrangements are sometimes necessary but more than make up for the inconvenience they introduce during design and construction. These sheaves, belts and idlers comprise the drive for the cluster head shown in the other photograph. The head bores, chamfers, faces and grooves the housing for a transmission.

Eliminating Vibration from the Tool

Use of a portable electronic vibration analyzer assures that the lathes shipped by the Springfield Machine Tool Co., Springfield, Ohio, are dynamically balanced. The analyzer, a product of the International Research and Development Corp., is



PORTABLE VIBRATION ANALYZER consists of a seismic pickup with filtering probe, a stroboscopic lamp and a cabinet containing electronic frequency and amplitude circuits. When the probe is placed on machinery close to an unbalanced and vibrating part, the vibration is transmitted mechanically to the pickup. The pickup housing moves with the vibration. Freely suspended inside the pickup housing, within a magnetic field, is an aluminum bobbin wound with fine copper wire. Because of inertia, the bobbin remains still, thus generating electric current.

The generated current fires the stroboscopic lamp at the frequency of vibration. When the lamp is trained on the part being checked, it visually freezes the motion. This makes possible observation not only of original vibration, but of progress in balancing.

-ed at final inspection. The instrument makes quick work of a job that could take hours and assures balanced, vibration-free operation.

Small lathe production is spot checked about twice a week but machines with swings of 25 inches and up are all checked. Few need attention, but no machines are shipped that fail even by 0.0001 inch, to meet standards of dynamic balance as well as physical tolerances. The analyzer enables inspectors to pinpoint the occasional unbalance that may develop in any assembly of rotating parts.

With former procedures, a vibrating lathe had to be painstakingly inspected. Each rotating part had to be checked individually, some on static balancers, until the part causing the vibration was located. Then that part had to be removed and balanced away from its natural environment. With the portable analyzer, an inspector is quickly able to determine the source of unbalance—whether in belts, sheaves, face plate, spindle, motor or gears. This information is obtained without disassembling the lathe or removing any part.

Any necessary balancing can usually be done on the spot, with the part rotating at design speed in its bearings and in its normal relation to other rotating parts. The inspection routine covers three main points: (1) the sheave end of the motor shaft, (2) the V-belts and gear drive sheave and (3) the faceplate. The motor is checked individually if there is any reason to believe it is vibrating beyond acceptable limits. The vibration tolerance for the motor, pulley and the face plate is 0.0005 inch.

Face plates of large lathes are the most likely sources of unbalance. Being castings, occasional slight variations in homogeneity or hidden blowholes may create small factors of unbalance which are greatly amplified as the speed of rotation increases.

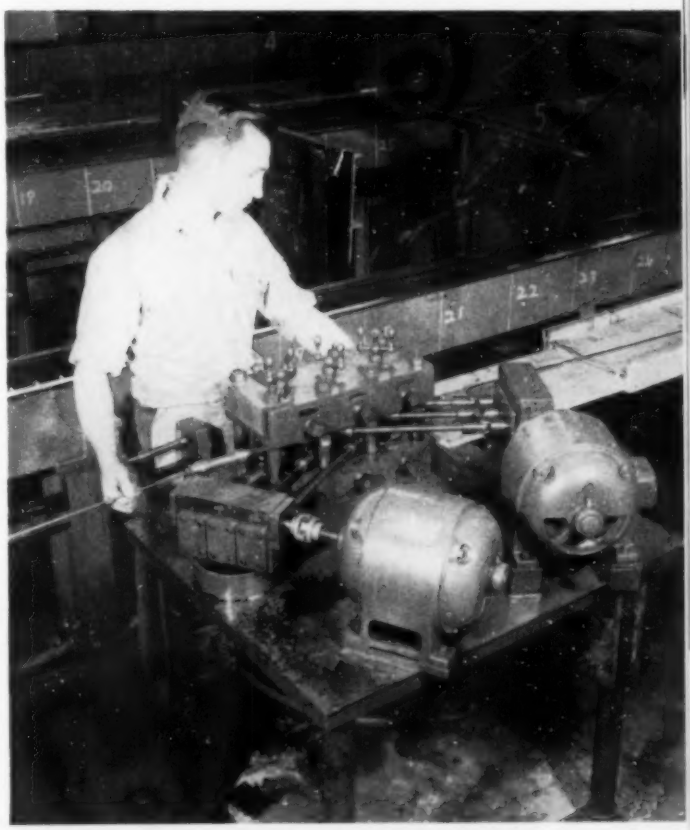
Rotary Straighteners Assigned Other Tasks

Derodding and skin hardening of brass, Inconel and other heat and corrosion resistant alloy tubes is now being accomplished by Precision Tube Co., Inc., North Wales, Pa., with a rotary straightening machine. The derodding operation is assigned the machine when plug draws cannot be used. Derodding takes place on tube with thin walls, generally under 0.020 inch. Such tube is conventionally drawn over a mandrel to specified diameters up to ½ inch with the die setting the OD and the mandrel controlling the ID.

As each 14 to 16-ft length of tube is released by the draw bench, the derodding operator picks up the length and starts it through the six power-driven rolls of the straightener unit. The rolls of the Mackintosh-Hemphill Co. machine work the tube metal so its diameter is increased a few thousandths of an inch. This lifts the tube away from the mandrel, which is then easily slid out of the tube and returned to the draw bench. Derodded tube is then given a light sink pass.

Precision also operates a larger rotary straightener for skin hardening jobs. This model straightens copper and brass tube in lengths up to 30 ft. Diameters range from ⅜ to ⅞ inch and walls vary from 0.007 to 0.080 inch. A straightness of no more than 0.010 inch deviation per ft is required.

Skin hardening is done on dead soft copper tube that has been drawn to size and annealed. One pass through the machine raises the Rockwell 15-T hardness from 53 to at least 59.



DERODDING OF THIN-WALL tube is accomplished in a rotary straightener by increasing the diameter a few thousandths of an inch. Three sets of rolls provide ample coverage of the surface for fast derodding and absence of machine guides insures an unmarred surface. Tube is then given a light sink pass.

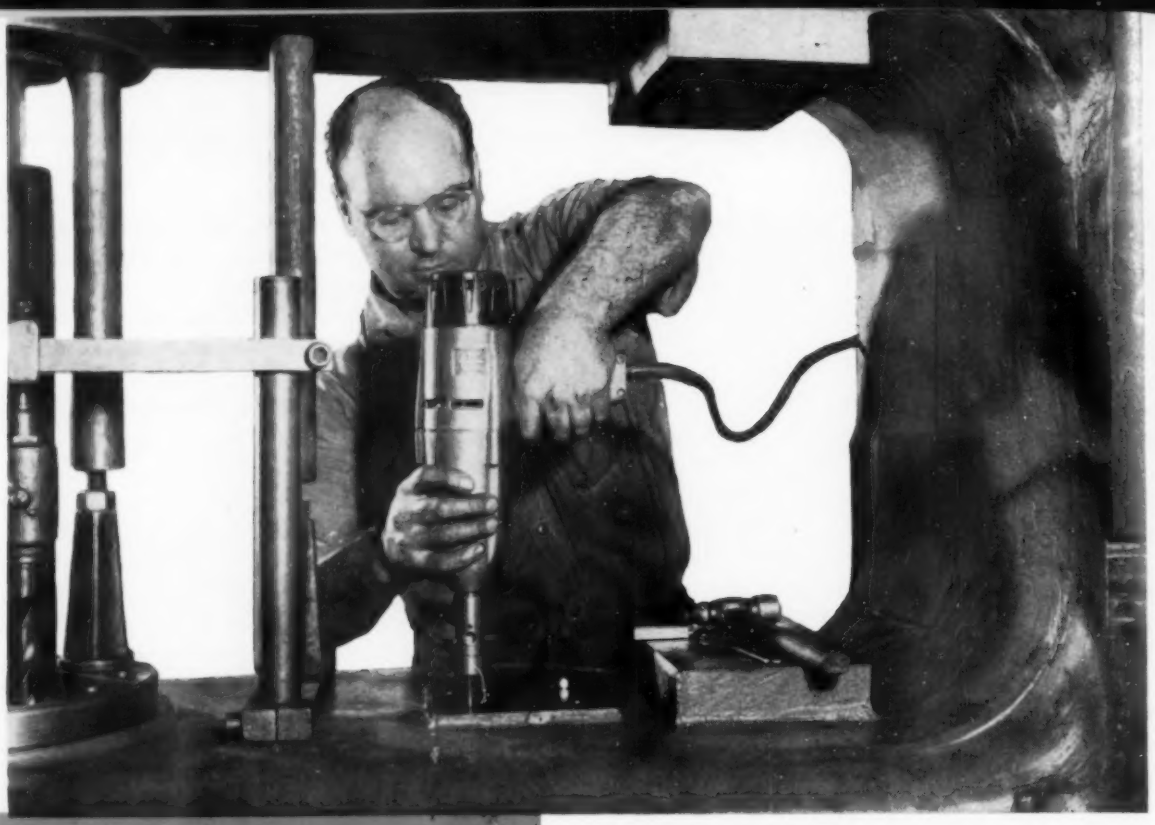


Fig. 1. One-half-inch tap is turned with an electric tool. Part is a bumper block for a turret punch press.

tapping with power tools

By E. A. Barten

Chief Engineer
Wiedemann Machine Co.
Philadelphia, Pa.

TIME CONSUMED in tapping holes in turret punch press castings has been lowered by driving taps with portable impact-type electric tools in place of hand tapping methods. Castings are too unwieldly to be drilled and tapped in a drill press. A faster method, *Fig.* 1, was sought by Wiedemann Machine Co. because hand tapping consumed too much time.

According to tests made by the company a hole can be tapped in cast iron in 30 seconds with a portable tool. Ten minutes are required for conventional hand methods using the same size tap. Thus, time reduction is 95 percent. Press castings must be fitted into place, bolt hole positions measured and then drilled and tapped during assembly.

For example, fifty holes are power rather than hand tapped in one model turret press, saving over ten hours assembly time per machine. Seventy-six holes, ranging from ¼ to ½ inch, are power tapped in another size press. Time saved tapping three or four presses is enough to pay for one tool.

Power tapping is used daily for assembly and installation holes for components on all parts of the sixteen press models and special machinery built by the company. Portable tools are used to tap holes for chain support brackets, oil pumps, gear housings, brake drums, index pin brackets and bumper blocks, *Fig.* 2.

A large-size portable tool is rated to turn tap

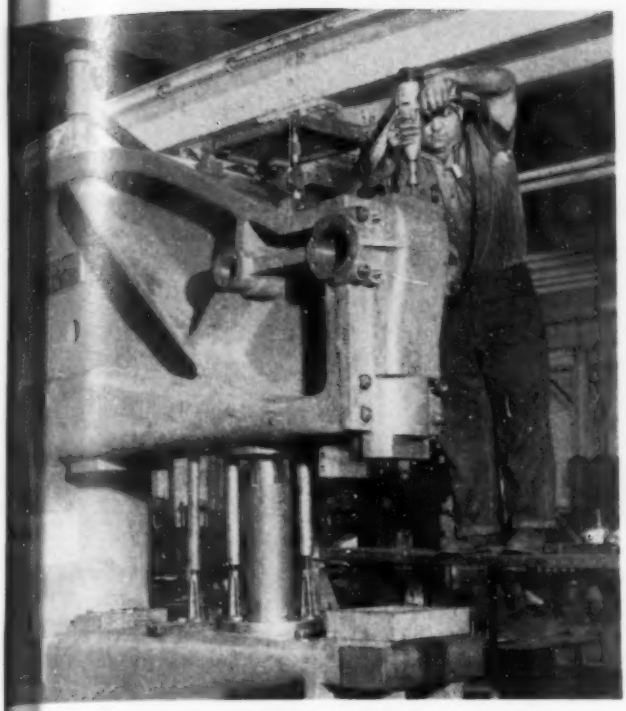


Fig. 2. Operator taps ⅝ and ⅞-inch holes in press frame for motor plate that would be inaccessible for a drill press.

Fig. 3. Workman is cleaning threads on press frame holder with small size portable tool at considerable time saving over previous hand methods.

sizes up to ⅝ inch; a smaller tool holds sizes up to ⅜ inch. The smaller tool is used for assembly line work on the smaller presses. This tool operates two, and sometimes eight to ten hours per day, depending on work progress.

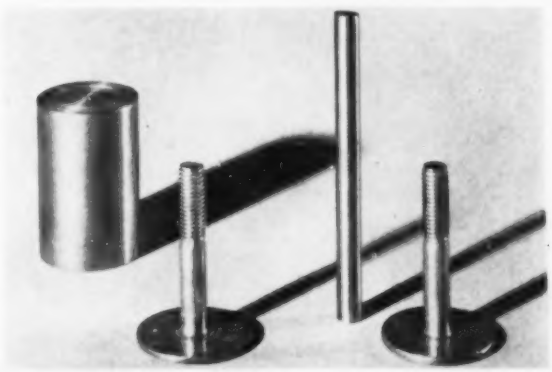
In addition to production tapping, portable tools are used for enlarging holes, nut running and thread cleaning, *Fig.* 3. It has been found that impact-type tools minimize operator fatigue because they do not kick or twist under sudden overload. They operate as any standard electric tool until resistance is met. Resistance is overcome by automatic impacts delivered to the work. As a result, small parts can be tapped without being held in a vise.

Cold Forming Reduces Scrap

SAVINGS IN MATERIAL as high as 85 percent are being achieved by metalworking producers who have switched to cold forming techniques for production of certain parts. Considerable scrap results when bar stock must be machined down to a desired size and shape. Through the Cold-Flow method, developed by Camcar Screw & Mfg. Corp., all metal is put into the part being produced.

Comparative figures of identical parts (illustrated) produced by both methods show that 210 lb of stock material were required per thousand pieces as opposed to 8.3 lb of wire material per thousand pieces made by cold forming.

Recent advances in cold forming machinery, dies and materials offer important advantages. The process permits production rates up to 400 parts per minute with surface finishes as fine as 10 to 15 microinches, rms, and tensile strengths up to 180,000 psi. Upsets as high as 8 to 9 times the diameter of the wire may be achieved. On small shank dimensions, tolerances can be held 50 percent closer with cold forming than machining methods while on other small part dimensions tolerances are comparable to results of other methods.



controlling tools graphically

By Otto M. Jank

General Manager
Lone Star Ordnance Div.
Day and Zimmermann, Inc.
Texarkana, Texas

Fig. 1. Card file helps improve tool expediting and inventory control at munitions loading plant. A clerk checks a tool requisition against the master tooling file to determine if sufficient tools are ordered to meet anticipated production requirements.

MAINTAINING large tool inventories and distributing supplies in munitions loading plants is a difficult task. Parts and components for munitions must be kept in short supply because of constant redesigning and because production goals are set for short terms and can be changed any time. Distribution of materials is difficult because of the restrictions on quantities of explosives that can be stored in any one place and the distances required between points where explosives are handled. Because assembly lines are widely separated, tool control is a major problem. A new procedure was established by one ordnance plant to circumvent these limitations by graphically controlling distribution and supply inventories. A similar system can be instituted by any plant having widely scattered tool cribs.

Two major decisions were made to improve control of tooling and hand tools:

1. Because production lines must be properly tooled, responsibility of overseeing tooling was given to a senior engineer, head of the Work Order Control Dept., who could anticipate tool needs in their proper sequence.

2. Time wasted by workers obtaining tools at distant toolrooms and returning to work stations was eliminated by establishing toolrooms near production lines.

Toolroom Records: Management controls are used to prevent depletion of key items in the toolrooms. Inventory and purchase control records are

kept under a system using Remington Rand Kardex equipment and Sched-U-Graph boards. Each item in each toolroom is assigned a separate pocket in a card file, *Fig.* 1. Contained in each pocket is a stock record control card on which are recorded a description of the item, its stock number and a listing of the established maximum and minimum stock levels to be maintained in the toolroom.

Items issued or received by the stock room are entered on the corresponding file card, *Fig.* 1. Also entered are the transaction date, quantity issued or received, material order number, receipt order or vouche number authorizing the entry and the new balance on hand. When the new balance falls below a minimum level, a purchase requisition is written to cover a predetermined quantity.

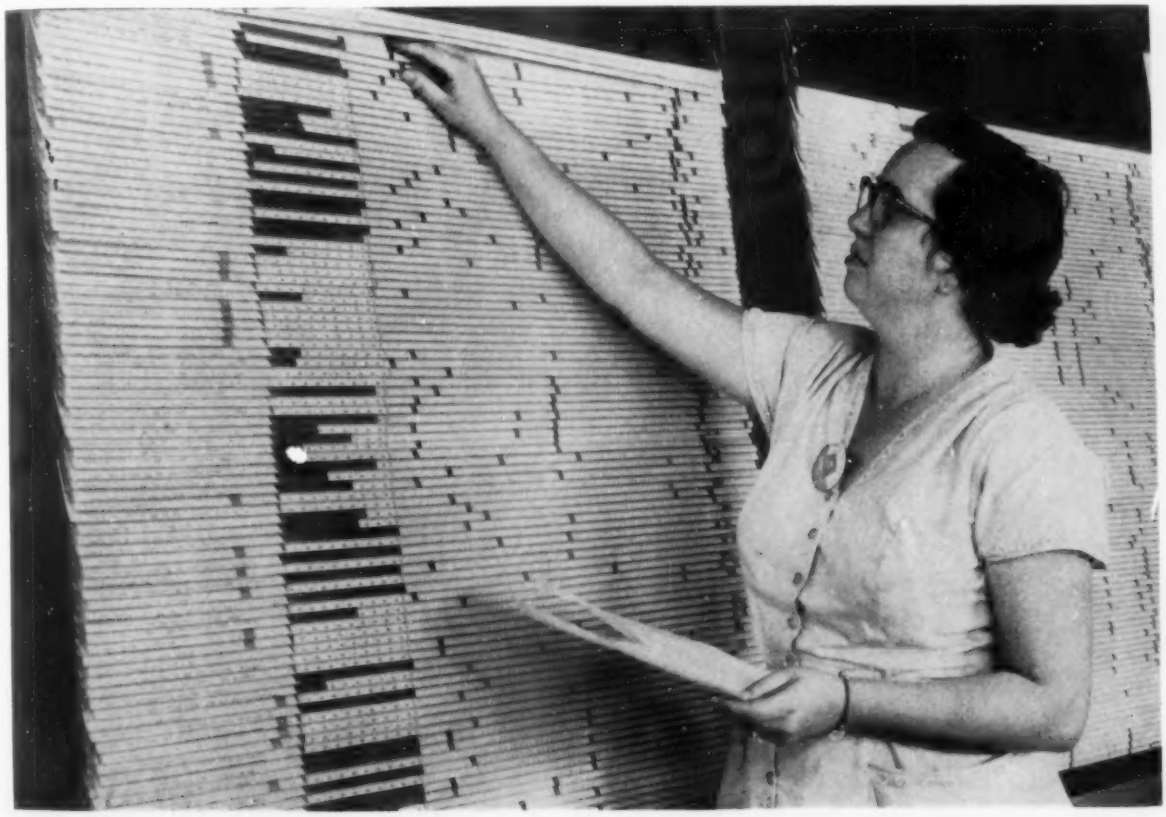
Work Order Control: The requisition is forwarded to the Work Order Control Dept., where usage of the item is reviewed on the basis of records kept in a master tooling file. If necessary, the amount ordered is adjusted up or down to coincide with anticipated consumption. This review is of major importance because ordering policies cannot become static.

When the Work Order Control Dept. receives an initial requisition from the toolroom an entry is made on a card similar to the one kept in the toolroom. This card is used only to control and follow through purchases of tools and tooling. The entry includes the date of requisition, requisition number and the quantity ordered. A new entry is made if these figures are changed by the purchase order which is ultimately issued.

Purchasing Control: An insert card is filled out when a purchase order is issued for material from outside suppliers. Part name, order number and requested delivery date are recorded on the card, which is filed at the left side of a 40-inch wide schedule control board, *Fig.* 2. Status of the boards is checked each day, and a more thorough review is made at least once a week.

As deliveries are received from suppliers Receipt of Materials forms are filled out and sent to the Work Order Control Dept. If a partial shipment is received, the insert card is posted and the balance due is noted. The schedule control board is adjusted so that the expected delivery date for the balance of the shipment is listed on the proper date scale. When all items of an order are received, the control line on the schedule control board is eliminated and a notation is placed in the control pocket listing the Receipt of Materials form number and the number of items received. The order is then balanced to zero.

Fig. 2. Information for purchased items is written on insert card and filed on schedule control board. Essential data is graphically displayed to supervisory personnel through plastic margins.



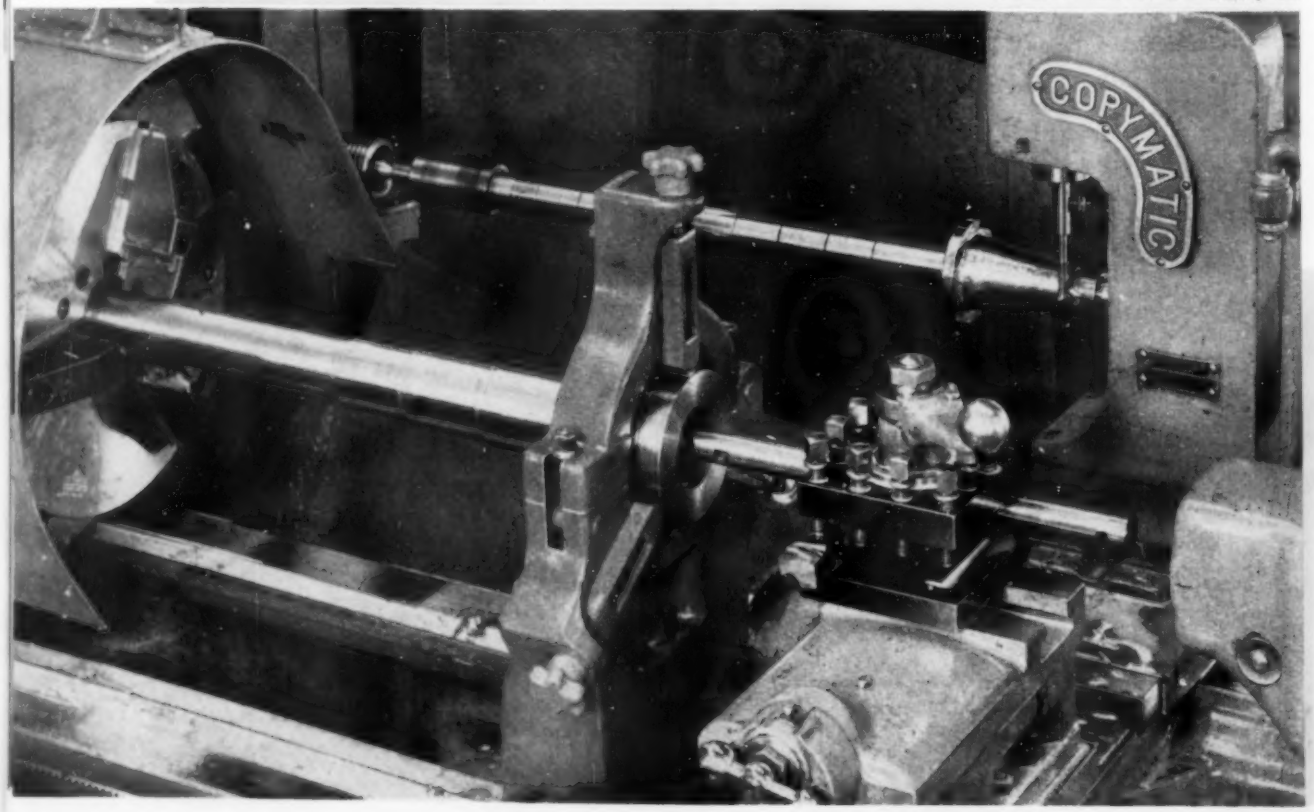
TOOLS at work

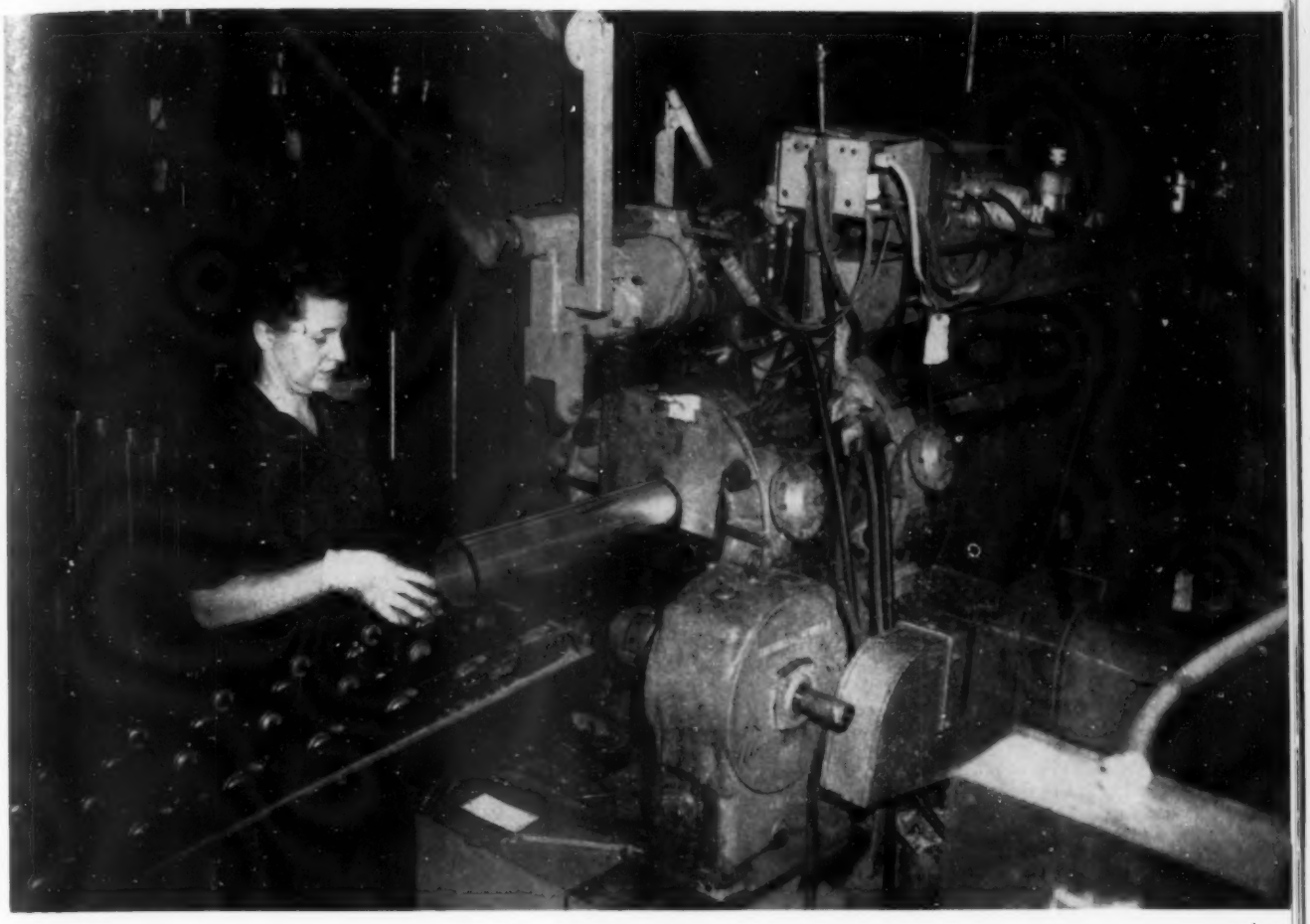
—Photo courtesy Master Manufacturing Co.

FACE MILLING a steel workpiece at a 45-degree angle on a horizontal mill is performed by means of a converter head and a three-inch diameter shell end mill. A cut of 0.300 inch is taken at a feed rate of 4½ inches per minute.

PRECISION TAPER BORING a number 50 NS inside taper in a steel forging workpiece is performed at the George Gorton Machine Co. with the spindle operating in reverse. The cutting tool is machining the bore, which starts with a 1⅜-inch diameter straight side hole, at the rear side. The part is a machine spindle and a finished mating arbor is being used for a round template eliminating need for a conventional flat template yet providing accurate duplication. Machining time is 90 minutes at a speed of 136 rpm and feed of 0.010 ipr, saving 57 percent over conventional methods.

—Photo courtesy Lodge & Shipley Co.

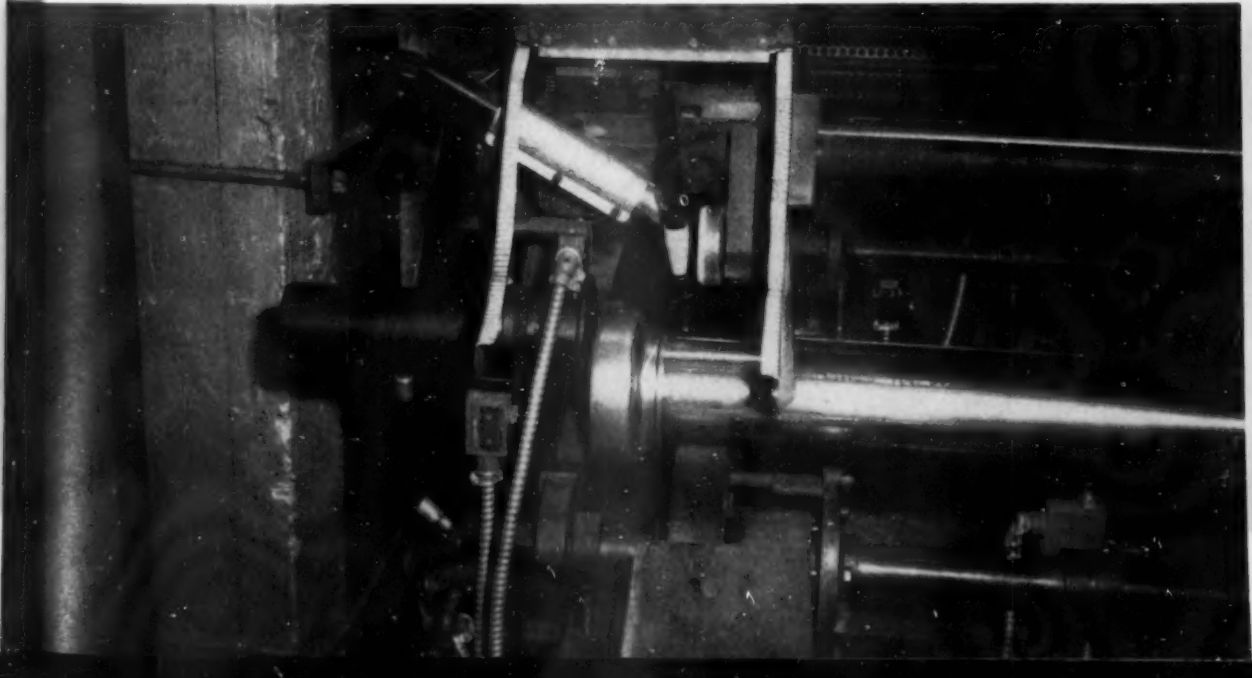




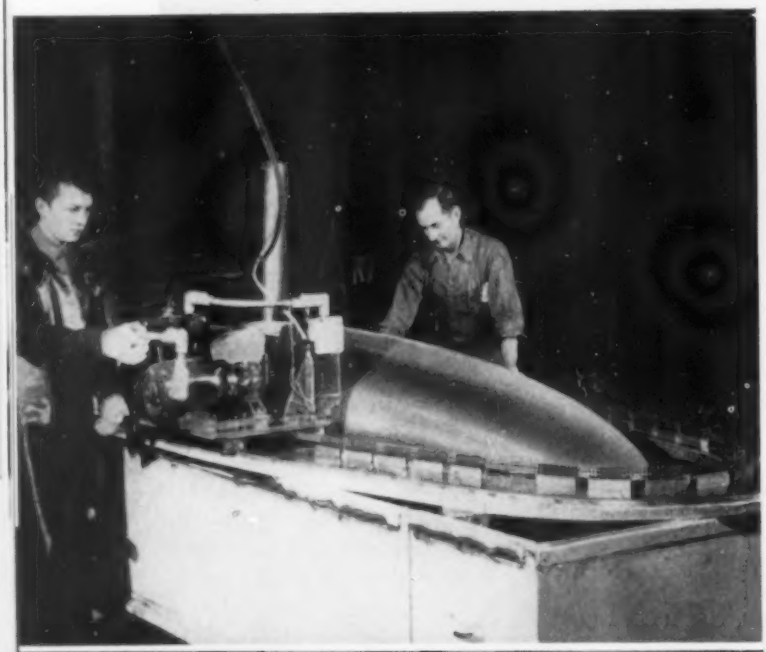
AUTOMATIC SIGMA tube welding machine rolls out cylinders at speeds up to 200 inches per minute in the fabrication of aluminum cartridge tanks. The cylinders are made of 0.051-inch 3S aluminum stamped and formed blanks about 4½-inch diameter. The 34-inch longitudinal weld is made in about 10 seconds. The part then goes to the operation shown in the illustration below.

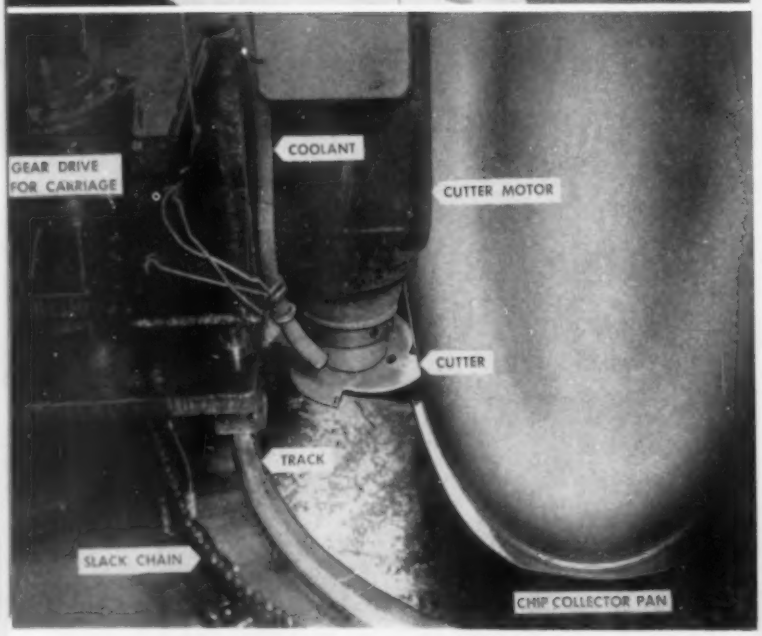
Automatic heliarc welding machine fastens 10-gage aluminum cup to trimmed end of welded cylinder. The cup is held in place by a back-up mandrel inserted in the cylinder. The unit is inserted in a jig which rotates under the torch. Each weld is completed in 12½ seconds.

—Photos courtesy Linde Air Products Co.



TOOLS at work





Vacuum holding solves a difficult workholding problem in this special flange trimming machine. After trimming, two sections are seam welded to form aircraft gas tanks. In designing this machine to do the job, tool engineers at Pastushin Aviation Corp., Los Angeles adapted a Roots vacuum pump to pull air from a vacuum chamber, which, acting as an accumulator in reverse, quickly exhausts the workholding chamber. A skeleton fixture with a vacuum seal supports the tank section and provides for a workholding force of 24,000 pounds distributed over the 2400-sq. in. area of the workpiece. Cutter is a 4-tooth carbide-tipped saw powered by a 3600 rpm motor. This unit rides on a wheeled carriage guided by tracks and driven by a separate motor coupled to a gear reduction right-angle drive. A stationary chain engaged by a sprocket on the carriage furnishes the traction. Operation of carriage, coolant supply and saw are initiated by a pushbutton. A limit switch automatically stops the machine at the end of the cycle. The elliptical cut is 200 inches long, but requires only 40 seconds to complete.

SPECIAL MACHINE cuts drilling time

By L. C. Seager*

Tool Engineer
Eimco Corp.
Salt Lake City, Utah

Fig. 1. Special machine drills 77 ⅛-inch diameter holes in eleven rows in periphery of hydraulic clutch drums. Each row contains seven holes. Heads are raised progressively in 11/16-inch steps. Machine, fabricated of commercial drill heads and an index table, replaced slower hand methods.

EXCESSIVE MACHINING TIME can be reduced by designing and building special machines for specific operations. Company engineers are close to production problems and can often fabricate machines economically on the premises.

Laying out and drilling holes in hydraulic clutch drums at one company formerly required more than an hour for each piece. Individual pressure relief holes in the periphery of drums were laid out and drilled on a single-spindle drill press. Engineers designed a compact machine, *Fig.* 1, which eliminated layout and reduced drilling time to an economical minimum.

Seven purchased electric heads drill 33 to 77 holes, depending on the clutch drum style. Heads are actuated simultaneously. Each head can be shut off by switches mounted on the front panel, which control the number of holes required. Design changes affecting hole spacing are made by securing a head in a screw and taper wedge mounting, *Fig.* 1, lower left.

Drums are indexed in eleven equal increments

Fig. 2. Space for portable chip disposal cart was created by installing the electrical control box on the rear wall of the machine.

*Senior member ASTE Salt Lake City chapter.

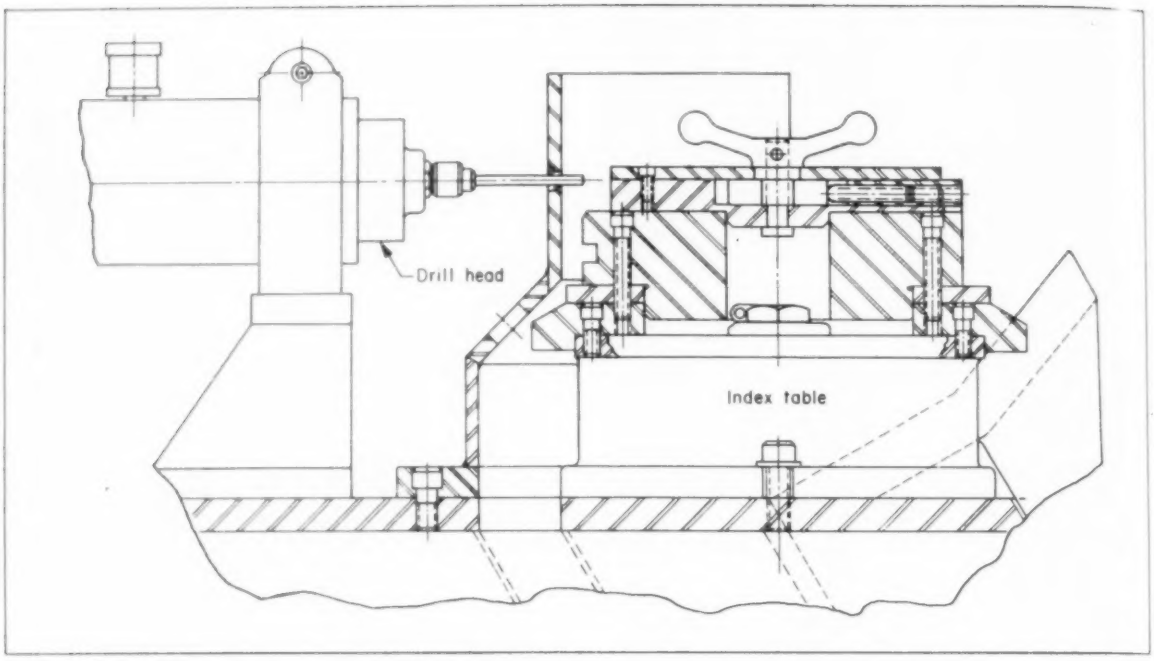


Fig. 3. Section shows part and three-point cam clamp which secures clutch drum in jig for drilling. Index table and drill heads are automatic.

with a commercial air-electric rotary work feed table, *Fig.* 2. The two-minute index cycle is actuated by a pushbutton on the front control panel. A reset button facilitates setup and is also used for resetting when the cycle is interrupted after partial completion.

Precision switches are mounted on each head behind the feed control to prevent the index table from moving until all heads are in rear position. The unit will not index until precision switches are actuated by all heads. Individual heads can be stopped without affecting the cycle.

Clutch drums are quickly aligned and secured in the unit by a three-point cam clamping device, *Fig.* 2.

Chip disposal is aided by mounting the machine head on a 30-degree angle. A sheet metal chute guides chips through holes placed at intervals in the inclined face. Chips empty into a disposal cart, *Fig.* 3, which is accessible through a door in the machine base. Because the clutch drums are alloy cast iron, a coolant system is not required.

Design and construction costs of the unit were justified by increased production and easier handling. These advantages were not possible with previous layout and hand-drilling methods.

Engineers Make Bargain Husbands

QUESTIONNAIRES bring to light facts on almost everything. Recently, one mailed by the Illinois Institute of Technology returned evidence to prove engineers make good husbands. Almost 3000 alumni responded to questionnaires sent to samplings of the school's classes of 1929, 1934, 1939 and 1949.

The Institute found that 90 percent of the replying graduates had married, yet divorces totaled only one in the class of 1934 and two in the class of 1929.

Comparing these figures with the national rate of one divorce in every four marriages, the school concluded that engineers make pretty good catches. Earl C. Kubicek, director of alumni relations and replacement, noted possibility that economic security of the engineers was responsible for lack of financial friction and probably fostered domestic tranquillity.

Finishes for Metals

Organic Coating Components

By **Robert A. Wason**
Associate Editor

Organic finishes are formulated in an ever-increasing number of combinations of standard and new components. Before the finishes can be selected or applied, the igredients should be known and their effects understood. This article describes many of the components of organic finishes and indicates what influence each can be expected to have on a formulation. Next month, another article will describe representative coatings and their typical applications.

—Photo courtesy Westinghouse Electric Corp.

The transformer tank on the right has a standard production finish that had been considered best available when it was selected. Because shortcomings of the system were known, continued investigation resulted in a special three-coat system. After both transformer tanks were subjected to a 1000-hour salt spray test, superiority of the new system was clearly evident. In a few years, a new system may be developed that will make the current finish look as shabby as it now makes the former standard appear.

TO DO A GOOD JOB, a finishing system must prevent the corrosion and resist the temperatures and abrasion to which the product will be exposed to give a reasonable service life and add necessary eye appeal. To be economically feasible, a finishing system must be designed to minimize production problems. High production rates may require that the finish be applied by automatic or semiautomatic methods. Drying times of finish system components can influence storage, packing and delivery of the finished product.

Much practical information is available in the field of metal finishes, but many of the known facts are applied without understanding. For example, it is known that the thinner the applied finish coat, the greater is the adhesion of that coat but so far, there is no scientific explanation of this

fact. It is also known that thin coatings have better resistance to thermal expansion and contraction. If there is correlation between these two facts, it is not yet recognized—but the lack of a reason does not prevent application of the knowledge. A particular finish should be specified only after consultation with a reputable supplier of finishing products.

It is known that certain additives can be used to increase the adhesive properties of a particular film, but there can be changes in the finish, while it is in storage, that cause it to have less adhesion than an unmodified formulation. All the characteristics of the various portions of a finish system must be known before it is used. Adhesion to base metals is important only for the first coat. Succeeding coats should be chosen for their adhesion to each other.

When the emphasis in selection of finish is placed on protective properties, the choice of color is frequently limited. Finishes of two different colors, although compounded of the same resinous binders, may have entirely different properties. This indicates that the color of a system should not be changed without first testing the new combination.

The end-use of a product is of paramount importance during the selection of a finishing system. As an example, a finish for aircraft must be able to resist the erosion of rain, sleet and snow at high speeds. Also, excessive vibration could loosen a coating if it does not adhere tightly to the base metal. Other applications require finishes to resist scuffing abrasion. Some finishes can effectively resist abrasive action when it occurs at 90 deg to the surface but have practically no abrasive resistance if the action occurs at a low angle.

The actual thickness of a coat is specified in accordance with the intended use of the product. This takes into account not only exposure to atmospheric conditions, chemicals and temperatures, but also the mechanical wear to which it will be subjected. For example, the thickness of auto body paint is determined by the abrasive action of gloves or skin at areas around door handles. Coating thickness can be altered by changing the composition of the coating or by adding extra coats.

They're Not All Paint

The term "paint" is loosely applied to all types of organic coatings but actually represents a particular type of formulation. Paint is a liquid solution comprising pigments and an oil vehicle that dries by oxidation into a solid opaque film. Paints always contain pigments.

Varnish is a finishing material, with a vehicle compounded of resins and drying oils, that dries to a transparent or translucent film by oxidation polymerization or both. Varnishes never contain pigments. A formulation consisting of a resin plus a plasticizer in a suitable solvent is called an enamel. A varnish or lacquer base can be used. Enamels are always pigmented and they dry by oxidation, polymerization or both.

Lacquer is a cellulose solution, with or without other resins and plasticizers, that dries by solvent evaporation. Lacquers can be colored or unpigmented. These definitions are exact, but the trend

—Photo courtesy United States Rubber Co.

A finish having the proper characteristics has little value if it cannot be easily applied. An air-dry plastic coating is being sprayed on a wheel that will be used to carry yarn in a textile plant. Such applications require resistance to wear and chemicals.

in formulating organic coatings is toward incorporating the best features of paints, varnishes, lacquers and enamels in one product.

Components of Finishes

Modern finishes are carefully formulated from various pigments, resins and oils. The indiscriminate use of reducing oils, thinners and varnishes is not recommended because their addition would unbalance the formula.

Organic coatings are applied as liquids and comprise volatile and nonvolatile components. The volatile components enable application of the finish as a continuous, smooth film. They consist of solvents and diluents. Nonvolatile components form the finish film and include oils, resins, waxes, pigments and plasticizers (softeners).

The vehicle in a finish contains the film-forming materials and is the foundation of all finishes.

Vehicles frequently contain thinners to control film thickness and flow, and driers to speed the drying of the finish. The main components of vehicles are drying oils or resins. Pigments may or may not be included in a finish depending on the type it is. Pigments are held in suspension in the vehicle.

Pigments: The film forms a barrier between the elements and the metal surface and, because organic film formers do not completely exclude moisture, pigments are added to reduce the rate of moisture penetration or its effects. Pigments are also used to give a desirable color to the film and protect it from the harmful effects of ultraviolet rays from the sun. Although pigments protect metals, they themselves need protection.

A pigment retains opacity when wet; a filler material ordinarily does not. Those fillers that retain opacity when wet are called extenders or auxiliary pigments. Talcs and soapstones are extenders. A pigment that is mixed with a filler or extender is termed a reduced color. A filler that does not have good hiding power by itself, such as silica, can increase hiding power and depth of color of a pigment if it is sufficiently fine to be dispersed between the pigment particles.

Red lead is a rust inhibitive pigment of great hiding power and brilliance. Red lead that is not completely oxidized and therefore contains litharge must be applied immediately after mixing with its vehicle to avoid combination with the oil. Red oxide is another useful pigment that does not inhibit corrosion but does filter out ultraviolet rays. This pigment will not bleed through surface coats and has excellent resistance to weathering, weak acids, alkalies and heat. It has good hiding power.

Zinc chromate has poor hiding strength, fair resistance to heat and fair resistance to alkalies but is one of the best rust inhibitors. It will not bleed through surface coats. Although zinc chromate is slightly soluble in water, it is satisfactory for underwater use when used with phenolic vehicles.

Primer and surfacer coats containing zinc pigments should not be wet sanded because this presents a health hazard. When these materials are sanded dry, the dust should not be inhaled and it should be vigorously washed from the skin. Zinc oxide has fair hiding qualities, good resistance to heat and excellent resistance to light.

The organic phthalocyanine blues and greens can be used in coatings exposed to elevated temperatures. In addition, many inorganic pigments are available for elevated temperature use and can match the colors offered in standard finishes. These pigments include: cadmium sulfide yellow, cadmium sulfo-selenide oranges and reds, cadmium selenide maroons, titanium dioxide white, cobalt oxide blue, chromic oxide green, and yellow and red iron oxides. These inorganic pigments are usually expensive compared to organic pigments.

Metallic pigments, particularly aluminum which will be described later, can be used in vehicles for special effects and because of their great hiding power. Luminous pigments are usually zinc and calcium sulfide and they react with and must be protected from lead, manganese and cobalt.

White predominates in home laundry equipment because of its resistance to alkalies. Blues and greens tend to show alkali marks readily. The greater the heat to which the finish is subjected, the deeper the color that should be used to minimize discoloration. Until the advent of high-temperature silicone finishes, the possibilities of using color at elevated temperatures were limited.

Even without the requirement for high-temperature use, color pigments must be chosen carefully. Chrome yellow fades easily. Yellow ochre is more durable but is not as pleasant a color as the chrome pigment. Prussian blue (ferrocyanide of iron) is a good color but not permanent. Cobalt blue is both pleasing and durable, but is expensive. Vermilion (mercury sulfide) is quite similar.

Eye appeal and retention of color are not the only factors involved in choosing colored finishes. A whole line of coatings has been developed solely for the purpose of making finishes which, when applied next to each other while wet, will maintain their individual characteristics without interfusing.

Drying Oils: Straight drying-oil finishes are easy to use and have been used for a long time. Now, however, they are primarily used in maintenance and structural steel work. Linseed oil is the most important drying oil now used. Raw linseed oil base finishes should have a drier added at the time of use. Boiled linseed oil has had a drier incorporated in it without the loss of solids.

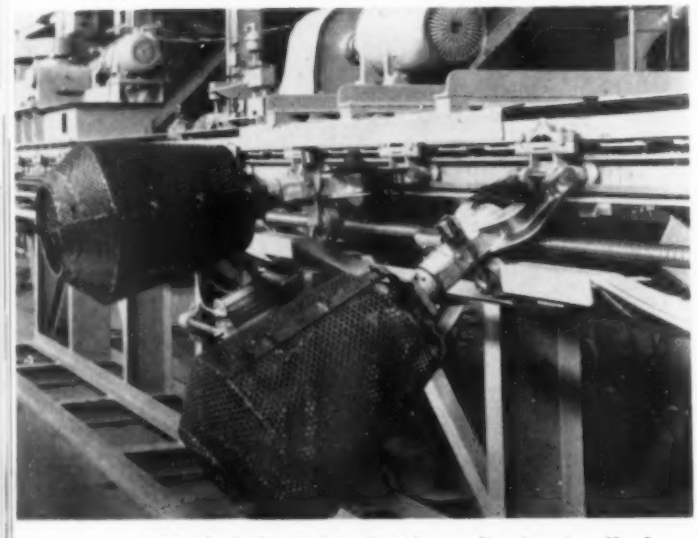
Tung oil (China wood oil) dries more rapidly than linseed and forms films that are more resistant to moisture. Perilla oil is similar to linseed but forms tougher films that dry faster and with greater gloss. Oiticica oil resembles tung and is used with other oils as a substitute for it. Soybean oil does not dry well and is used only with other oils that do dry well. It does not yellow readily and helps form an elastic film. Fish oils are used mainly with linseed oil. Dehydrated castor oil dries faster than linseed oil but slower than tung.

Linseed, dehydrated castor and soybean oils make softer films than do the other oils. Castor oil is more accurately classified as a nondrying oil and is used as a plasticizer in combination with other

oils. Castor and cotton seed oil have less tendency to lift in lacquer-alkyds than does soybean oil.

Resins: The use of synthetic finishes has paralleled the use of plastics. As each new plastic has been developed for use as a solid, a film or a filament, entire families of organic finishes have come into being. Resins can serve as vehicles alone or can be used with each other or drying oils.

—Photo courtesy Frederic B. Stevens, Inc.



Plastisols have found wide application in all phases of the plating industry. The barrels of an automatic plating machine have been coated by dipping. The thick, tough coating protects against plating solutions and resists abrasion by parts being plated.

NATURAL RESINS: These resins are the exudation of plants with or without being changed by the digestive process of insects. Rosin is by far the most important natural resin. It is obtained from pine trees. Rosin is combined with many different types of materials to form resins for organic finishes. Other natural resins include: elemi, congo, copal and lac. Elemi gives body and elasticity to lacquers while copal and congo give hardness. There are many grades of copal, but the hardest grade is harder than the gum dammar. Congo is the most insoluble of the natural resins, but after heat processing is soluble in many solvents.

CELLULOSE RESINS: Cellulosics are resins used in producing organic finishes characterized by smooth surfaces that are tough and durable, and with good resistance to many dilute acids and alkalies. Finishes formulated with nitrocellulose have good resistance to gasoline and water, fair resistance to mineral and animal oils, and low resistance to salt water, alcohols and vegetable oils. Nitrocellulose is highly inflammable, will discolor under long exposure to sunlight, and becomes hard and brittle with age. When combined with alkyds and a plasticizer, nitrocellulose can be used in finishes that have good gloss and gloss retention after polishing, and which require only forced drying. It is possible to patch and repair these finishes.

Cellulose aceto esters are resistant to light, burn slowly and have good resistance to acids and alkalies. They are so tough that it is difficult to obtain the proper degree of adhesion and their use for coating metal is limited. Cellulose acetate-butyrate (acetobutyrate) is combined with alkyd resins and results in a finish that possesses unusual durability on outdoor exposure and has good adhesion.

Ethyl cellulose forms a softer film than those of either nitrocellulose or cellulose aceto esters. This resin resists attack by hot concentrated alkalies but does not have good resistance to acids, moisture, gasoline and oil. It withstands sunlight without discoloring, has good electrical properties and toughness, and high and low temperature flexibility.

VINYL RESINS: Of high interest in the surface coating field are the thermoplastic copolymer vinyl resins. These resins vary both in the degree of polymerization and in the proportion of vinyl compounds. They are extremely inert at ordinary temperatures. They have excellent resistance to practically all acids, alkalies and oxidizing agents, and are not affected by gasoline, grease, alcohol or water. However, water resistance diminishes rapidly above 212 F. Vinyls are colorless, tasteless, odorless and nontoxic. They are used to protect against chemical attack and where resistance to abrasion and frequent handling must be combined with good appearance. When properly plasticized, vinyl films are tough and rubbery.

Vinyls dry by solvent evaporation and when they are used in organic finishes they are almost always the sole film-forming ingredient. They do not always release the solvent easily and sometimes must be baked for complete drying. Heating also fuses the film to the surface and increases adhesion.

Vinyl resins turn black if in contact with iron, steel, zinc and tin at elevated temperatures. Since vinyl finishes must be baked, vinyl films can be applied to these metals only over priming coats or by using a stabilized formulation.

Vinylidene resins have good resistance to acids, alkalies, water, gasoline, mineral and animal oils, and greases. They are highly impermeable to moisture vapor but have disadvantages as coatings because of poor adhesion and chemical instability.

Special fluid dispersions of vinyl resin in plasticizers are called plastisols. Because plastisol solvents are nonvolatile at room temperatures, the

ating must be baked at 350 F. The result is an extremely flexible coating that can protect metals against the strongest corrosives. Plastisols offer protection against all mineral acids, a number of organic acids, strong alkalies, salts, oils and oxidizing agents.

When cured, plastisols have no adhesion to metal surfaces. A special primer can be used to act as a bond between the vinyl and the metal unless the coating is to be strippable. Thickness of single coats can be controlled between 0.003 and ¼ inch.

Some plastisols have been formulated for spraying, but similar production advantages can sometimes be obtained more easily by using organisols. An organisol is simply a plastisol to which has been added a room temperature volatile solvent. After application, the organisol must be baked.

ACRYLIC RESINS: Thermoplastic acrylic resins have a water-white color, perfect transparency and a high resistance to discoloration. They have good resistance to water, alcohol, acids and alkalies. It is difficult, when using these resins as a primary base, to formulate a coating having good adhesion and flexibility with adequate hardness. Their chief value is as a modifying agent to improve water whiteness and resistance to discoloration of lacquers having other resins as a primary base.

The methacrylate polymers produce harder and tougher films with lower flexibility than the acrylate polymers. The methyl esters are correspondingly harder and tougher than higher esters such as ethyl or butyl, but likewise do not have much flexibility. Polymers of methyl methacrylate produce the hardest and toughest films, while polymers of ethyl acrylate are much softer and more flexible. They are usually used as copolymers to achieve the desired combination of properties. They are thermoplastic and films are formed by solvent evaporation. To obtain the best gloss, adhesion and hardness, the films can be baked at a moderate temperature.

The resin of this family most commonly used in metal finishes is polymethyl-methacrylate. It is expensive but valuable for its high resistance to discoloration at temperatures up to 500 F. The film adheres well to polished surfaces. Clear solutions of the resin are neutral and are often used in luminous paints as the binder.

If pigments are added to a clear acrylic resin vehicle, the film tends to be brittle, especially where pigmentation is high. To counteract this, plasticizers are required.

POLYSTYRENE RESINS: Polystyrene resins have excellent resistance to acids, alkalies and water but poor resistance to gasoline, oils and greases. They are colorless, tasteless and odorless. Although they have excellent flexibility, and wear and abrasion resistance, their use in organic coatings is limited because of the difficulty of obtaining satisfactory adhesion and toughness. Because they are high in viscosity and low in solids content, polystyrene resins tend to be stringy when sprayed. They are used largely as blending agents with other film formers and serve as vehicles for phosphorescent pigments.

UREA AND MELAMINE RESINS: In combination with other resins, thermosetting urea resins form coatings that are water white, do not discolor and are especially resistant to marring. They have good resistance to oils, greases and waxes, and fair resistance to weak acid and alkalies. Because of their brittleness and lack of adhesion urea formaldehydes are almost always combined with alkyds. In this combination, they contribute to fast baking time, hardness and mar-resistance. Also,

—Photo courtesy The Otis Elevator Co.

Through these elevator portals will pass many busy people. The sprayed lacquer top coat will resist the abrasion of scuffs and bumps, and preserve the appearance of the metallic undercoat for a long time.

they generally improve color retention. In combination with alkyds they have excellent adherence to metal surfaces.

The melamines are rated somewhat above the ureas. They are higher in cost, faster to dry, more heat stable and have better chemical resistance. Melamine resins are too hard for use alone in coatings and varnishes but they are combined with alcohol-modified urea-formaldehyde resins to give coatings of good color, gloss, flexibility and chemical resistance. Melamine resins can be used to replace urea resins in finishes and result in coatings with better heat stability.

Melamines can be cured faster than ureas or at a lower temperature. They have excellent outdoor exposure resistance. Melamines are used when exceptional color retention combined with resistance to abrasion and outdoor exposure is a requisite.

ALKYD RESINS: The alkyds are a group of thermoplastics characterized by homogeneity and solubility that make them good for varnishes and enamels, resistant coatings, calking compounds and plasticizers for others resins. They have high adhesion to metals, are transparent, easily colored, tough, flexible, heat and chemical-resistant, have good dielectric strength and are the most readily blended of the synthetic resins.

With alkyd resins, the plasticizing agent becomes an integral part of the resin molecule and provides internal plasticization. In addition to insuring a high-gloss film, alkyd resins in general offer good adhesion plus excellent weather resistance. Resistance to water, grease and chemicals, however, is not as good as that offered by vinyls. They have good color and gloss retention, chalk resistance and durability. Poor adhesion is a characteristic of some formulations.

Baked pigmented alkyds of various oils combine with melamine to give hardness, gloss retention, speed of bake, and moisture and chemical resistance but with a serious sacrifice in flexibility and impact resistance. With the incorporation of melamine or urea formaldehyde into the alkyd topcoat, an alkyd system seriously challenges nitrocellulose lacquer-enamels as the top auto finish. This baking system has good solids and builds a deep rich coating.

Ordinarily, alkyd resins are light colored and insoluble in drying oils. To make them a more suitable finish ingredient, drying oils are introduced into the reaction. The oils combine chemically with the alkyd to form what are commonly called oil-modified alkyd resins. The types of oils used vary and natural or synthetic resins may be added to achieve a wide range of properties.

Outstanding characteristic of oil-modified alkyd vehicles is their excellent durability. They dry to tough hard films that retain their flexibility and have high gloss and good color retention. In exterior durability, they surpass all other types, including 100-percent phenolic resin types. One of the chief reasons for this is their high resistance to the destructive effects of ultraviolet light. Oil-modified alkyd vehicles alone usually form a pale film. In enamels they have good color retention. They have good oil resistance, but where strong alkalies are encountered, the phenolics are better.

The oxidizing or air-drying types can be used as the sole film former or in combination with other drying oils and resins. When oxidizing alkyd resins are used in lacquers, there is always the danger of lifting when subsequent coats are applied. The nonoxidizing types are used as plasticizers in nitrocellulose lacquers and baking enamels.

The phenolic modification of alkyds is an attractive method of increasing drying speed, hardness and resistance to water, fuels and lubricants.

Alkyds are compatible in all proportions with nitrocellulose. Long oil alkyds dry more slowly but develop through-hardness more rapidly, while short oil alkyds are more durable when baked.

Baking type alkyds are favored over oleoresinous vehicles because of their marked superiority in color and color retention. Good adhesion, toughness, gloss, pale color and durability characterize the baking alkyds.

Nondrying alkyds function as plasticizers or tougheners for harder more brittle materials such as cellulose derivatives, and urea or melamine formaldehyde resins. The hardness of a nitrocellulose lacquer decreases as the amount of alkyd increases.

PHENOLIC RESINS: Finishes made with phenolic resins are tough and long lasting. They are used on metals exposed to acids, alkalies, moisture, heat, brine, smoke, fumes, and chemicals. As a group, phenolics have good durability and are high in chemical resistance but have poor color and gloss retention, and form brittle films. They are dark in color and are subject to discoloration when exposed to sunlight. When modified, their color retention is better and they can be used for white.

Desirable properties of phenolic resins can be enhanced and undesirable ones modified by the addition of any of a large number of oils and resins. Thermosetting phenolic resins can be divided into spirit-soluble and oil-soluble types. The spirit-soluble resins yield hard, glossy, abrasion-resistant films. Such films offer good resistance to solvents, acids and chemicals but resistance to strong alkalies is poor. Oils, chemical plasticizers and most other resins are not compatible with them.

When phenolic condensates and rosin are combined, a specific resin is formed. If the two are not chemically combined, the phenol condensate is insoluble and unusable in drying oils.

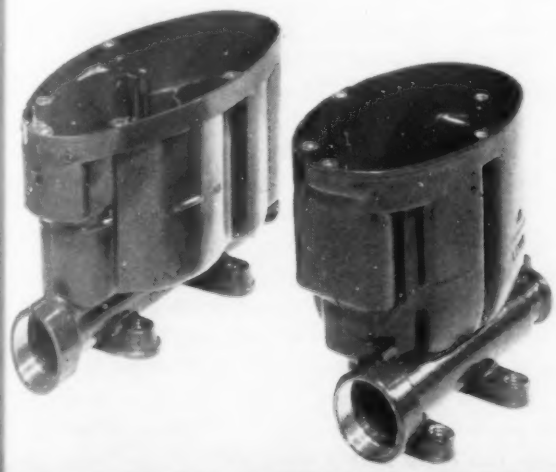
Certain substituted phenols yield resins that are soluble in drying oils and mineral thinners without the necessity of chemical combination with rosin. These are known as 100-percent phenolics and are reactive or unreactive, depending on the method of condensation in the presence of alkaline or acidic catalysts. The 100-percent phenolics offer the optimum in durability, toughness, chemical and moisture resistance. Some air-dry, others are baked.

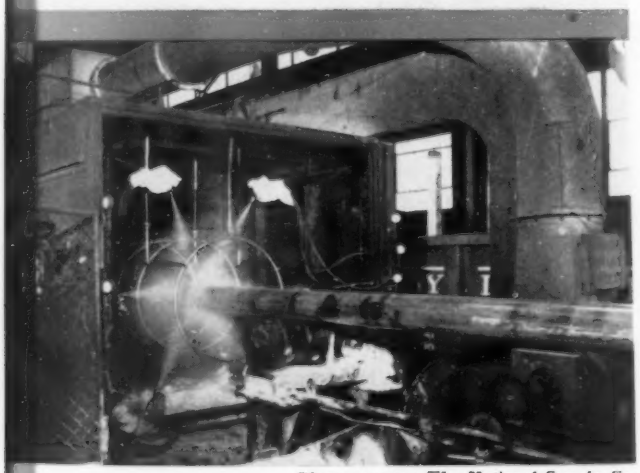
The reactive type yields quick-drying pale and durable finishes when cooked with tung oil. It is used to advantage in medium and long oil varnishes. The unreactive type yields durable and chemically resistant finishes in a wide range of oil lengths. These are used only with tung oil since they cannot contribute the necessary hardness to soft oils.

A modified air-drying phenolic (partially polymerized before adding solvent) resists acid fumes and is hard. Phenolics can also be modified with other resins, ester gums or drying oils. A relatively recent advance is a group of phenolic dispersion resins that are modified phenolics dispersed in thinners. They dry to the touch in about five minutes entirely by solvent evaporation, giving a durable finish. They have excellent adhesion to practically all metals. Another group of modified phenolics is used in nitrocellulose base lacquers to produce durable mar-proof finishes.

Oil control valves for space heaters are relatively simple products but the decision to change the finish on them resulted in complete reorganization of the production line. A complete facility was designed and constructed so that raw castings would be coated properly and automatically. The final steps are a dip in a vinyl plastic finish and a bake. The result is a corrosion-resistant coating that is not affected by rust, oil or sulfur, but which has a pleasant color.

—Photo courtesy A-P Controls Corp.





—Photo courtesy The National Supply Co.

Properly-selected finishes can be applied rapidly and automatically to keep pace with high-speed production. Seamless steep pipe from 2⅜ to 9⅝ inches OD is electronically sprayed at pipe speeds of 500 fpm. Four circular electrodes and six guns are arranged around the conveyor line. The guns automatically start spraying when the leading end of the pipe arrives and stop when the tail end has passed.

Epoxy Resins: Epoxies have color and gloss retention, chalk resistance and durability equal to alkyd systems and chemical resistance equal to phenolic systems. They are used either as converted films or esters. Epoxy finishes have good adhesion and resist impacts. Epoxies are some of the toughest, horniest resins known and impart this characteristic to the films in which they are used. Impact resistance is good as is flexibility.

They can be used to modify nitrocellulose lacquers and give finishes that are easy to polish and buff, give unusual build and fullness, exceptionally high gloss and toughness in black and many colors. Epoxy esters can be used in baked primers and epoxy acetate in forced-dry finish coats.

Incorporating a melamine in an epoxy coating overcomes the thermoplasticity but forestalls patching and touch-up. Too much nonoxidizing alkyd resin softens the film. The use of some or all oxidizing alkyd resin causes recoating problems.

Esters are made by reacting epoxy resins with oil fatty acids giving vehicles similar to alkyds in many characteristics. They were initially incompatible with nitrocellulose. However, a short-chain ester (acetate) is made that is compatible in all proportions with nitrocellulose.

Maleic Resins: The complex maleic resins dissolve in most oils to form high-viscosity vehicles that have good color retention and color, second only to the alkyds, and that dry well. In durability, they compare favorably with modified phenolics.

They serve chiefly as varnish ingredients in white as well as colored enamels. They are also used in many nitrocellulose lacquers.

When rosin-modified maleic resins are used in varnishes, they result in much lighter color and appreciably less yellowing than is the case with rosin-modified phenolic resins. Another important field of use is in sanding sealers. They are used in oleoresinous baking finishes, tin decorating finishes and for modifying alkyd resins. Maleic resins are especially useful in vehicles containing large quantities of soft oils.

SILICONE RESINS: Though actually a nonorganic resin family, silicones are used in finishes in the same way as organic resins. They comprise a family of materials in which silicon takes the place of the carbon in organic synthetic resins. They complement and extend the uses of organic finishes.

Air-drying coatings can be made of silicones and: phenolics, alkyds and acrylics. Silicones have found use as antifloating agents and leveling agents in a number of finishes. When used in epoxy resins and lacquers, silicones give improved flow characteristics to the films. Wetting is a problem if excessive amounts of silicone fluids are added to enamels.

GUM RESINS: Gums are specific types of resins that are used to increase body of a finish and give it hardness and gloss. Dammar is a good gum and is frequently used in lacquers. Elemi is a cheaper product than dammar and has properties similar to it. Kauri is used where good wear resistance is required and gives body, hardness and elasticity to a lacquer film. When baked, as in a japan, the gum fuses into a uniform vitreous layer.

Solvents: It would be impossible to describe all of the solvents or the manners in which they are combined. A solvent is simply a liquid having the ability to dissolve various materials without chemically changing them. Water is the most plentiful solvent, but is little used in organic finishes. The usual solvents for organic substances are the alcohols, ether, benzene and turpentine. The latter two are commonly used in paints and varnishes containing gums and resins. Ethyl acetate is an important solvent for nitrocellulose lacquers. Other solvents used in the manufacture of lacquer are: anhydrous alcohol, butyl, acetate, butenol, benzol and toluol. Benzol is a fast-evaporating solvent but is too toxic for general use. Toluol evaporates slower than benzol but is not as toxic. Hydrogenated naphtha is comparable but has less solvency than toluol. Cyclohexane is a good solvent for rubber, resins, fats and waxes. The nitro-paraffins comprise a group of powerful solvents for oil, fats, waxes, gums and resins. Blended with alcohols, they are used with cellulose acetate to produce good properties in nonblushing lacquers.

Other fluids used in organic finishes are diluents and thinners, which do just what their names imply. Volatility and solvency characteristics of these two additives can affect the adherence of paints based on either thermoplastic or thermosetting resins.

Plasticizers, or softeners, are liquids or solids that disolve in or dissolve a resin or gum and render the mixture plastic and flexible. A sufficient quantity of the plasticizer will result in a viscous mixture in which solid grains of the resin are suspended. It acts somewhat like a solvent, but unlike the true solvent the plasticizer remains with the cured film and imparts properties, such as flexibility, to it. Softeners used in lacquers are: amyl, ethyl and butyl phthalates. In addition, some resins act as plasticizers for other resins.

Driers: As their name implies, metallic driers are used to increase the drying speed of the coating in which they are used. They should be used carefully because an excess of drier will cause an excess of skinning and a decrease in durability. The decrease in durability is caused by removing some of the carefully balanced ingredients from the finish with the skin. Antiskinning agents are available, but if they are used, the speed of drying is reduced. Some pigments absorb some driers and thus reduce the varnish drying speed.

Lead, cobalt and manganese driers should be used in air-drying finishes. If manganese or cobalt driers are used in finishes where increases in temperature can occur before application of the finish, skinning is greatly accelerated. Cobalt is a powerful top drier. Manganese is similar to cobalt and is often used in baking enamels. Lead has excellent through-drying properties and is usually used with cobalt. Lead driers are quite reactive and cannot be used with some resins. Calcium is being used as an auxiliary drier with some alkyd resins. Zinc is a drier that actually delays the set time of a film but thereby promotes better through-hardness.

(To be continued)

Acknowledgments

The helpful cooperation of the following companies in supplying information for this article is gratefully acknowledged:

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Cutoff Tool Thickness Charts

By John Rimbach

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UNTIL RECENTLY, the correct thickness of a cutoff tool for a specific operation on an automatic screw machine or a turret lathe was determined by reference to a chart prepared many years ago. This chart was based on tool materials, machines, speeds and techniques of the time and does not reflect the advances that have occurred since its inception. Because of the possibility for saving material and in light of extensive experience, new cutoff tool thickness tables are presented. The correct tool thickness can be read directly from the tables if the diameter, the material and the form of the workpiece are known.

Material can be saved by using thicknesses indicated in the table because: (1) cutoff tools of new materials are thinner, (2) more thickness steps are included so it is possible to select a thickness close to the optimum and (3) thicknesses are listed separately by workpiece materials and forms. Based on technical and economical considerations, curves were calculated for optimum cutoff tool thicknesses for various materials in four forms. Since these curves indicated an infinite number of optimum thicknesses, ranges of ratios of workpiece diameters to tool thicknesses were set up to correspond with commercially available tools. For ease in use, this information has been tabulated for high-speed steel and carbide tipped cutoff tools in TABLES 1 and 2.

In all instances, hollow ground cutoff blades are recommended to obtain the smoothest cut. When runs are long, carbide tipped tools should be used. Cutting angles should be from 15 to 17 deg for cutting steel, and 23 deg for cutting brass and aluminum with high-speed cutoff tools. Cutting angles for carbide tipped cutoff tools should be between 5 and 7 deg for all materials. The new data apply equally to straight blades, circular tools and combination form and cutoff tools.

Comparison of cutoff tool thicknesses indicated by the former and the current data shows the material savings possible. Where the former data indicate a 0.140-inch blade for 1-inch round stock, regardless of material, the new data, presented in TABLE 1 for high-speed steel tools, indicate blades of: 0.090 inch for aluminum, 0.100 inch for brass and 0.120 inch for steel. This means a saving of 0.040 inch can be made on each brass part, or a saving of 3 full bars on a 10,000-part order. Even larger savings can be realized when workpiece diameters are larger.

Table 1—High-Speed Cutoff Tool Capacity (inches)

Material and Form		Cutoff Tool Thickness (inches)																	
		0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.070	0.080	0.090	0.100	0.120	0.140	0.160	0.190	0.220	0.250
Steel	From	—	3/32	1/8	5/32	3/16	7/32	1/4	9/32	11/32	13/32	33/64	5/8	25/32	1 1/16	1 13/32	2	2 21/32	4 5/32
	to	3/32	1/8	5/32	3/16	7/32	1/4	9/32	11/32	13/32	33/64	5/8	25/32	1 1/16	1 13/32	2	2 21/32	4 5/32	5 3/4
	From	—	3/32	1/8	5/32	3/16	7/32	1/4	5/32	21/64	25/64	15/32	35/64	11/16	29/32	1 3/16	1 21/32	2 13/32	3 1/2
	to	3/32	1/8	5/32	3/16	7/32	1/4	9/32	21/64	25/64	15/32	35/64	11/16	29/32	1 3/16	1 21/32	2 13/32	3 1/2	5
	From	—	11/64	13/64	17/64	19/64	23/64	27/64	31/64	19/32	49/64	63/64	1 7/32	1 5/16	2 3/16	2 29/32	4 7/32	—	—
	to	11/64	13/64	17/64	19/64	23/64	27/64	31/64	19/32	49/64	63/64	1 7/32	1 5/16	2 3/16	2 29/32	4 7/32	5 3/4	—	—
Brass	From	—	7/64	9/64	11/64	13/64	15/64	9/32	21/64	13/32	17/32	11/16	55/64	1 5/32	1 5/16	2 3/32	2 29/32	4 1/8	—
	to	7/64	9/64	11/64	13/64	15/64	9/32	21/64	13/32	17/32	11/16	55/64	1 5/32	1 5/16	2 3/32	2 29/32	4 1/8	5 1/2	—
	From	—	3/32	1/8	5/32	3/16	7/32	1/4	19/64	3/8	15/32	19/32	23/32	15/16	1 9/32	1 23/32	2 1/2	3 5/8	—
	to	3/32	1/8	3/32	3/16	7/32	1/4	19/64	3/8	15/32	19/32	23/32	15/16	1 9/32	1 23/32	2 1/2	3 5/8	5	—
	From	—	3/16	1/4	5/16	3/8	7/16	1/2	19/32	3/4	15/16	1 3/16	1 7/16	1 29/32	2 5/8	3 3/4	—	—	—
			1/4	5/16	3/8	7/16	1/2	19/32	3/4	15/16	1 3/16	1 7/16	1 29/32	2 5/8	3 3/4	5	—	—	—
Aluminum	From	—	9/64	11/64	13/64	1/4	19/64	11/32	25/64	31/64	41/64	13/16	1 1/32	1 11/32	1 25/32	2 13/32	3 15/32	—	—
	to	9/64	11/64	13/64	1/4	19/64	11/32	25/64	31/64	41/64	13/16	1 1/32	1 11/32	1 25/32	2 13/32	3 15/32	5	—	—
	From	—	1/8	5/32	3/16	7/32	17/64	5/16	23/64	7/16	19/32	3/4	15/16	1 1/32	1 11/16	2 5/32	3 1/8	—	—
	to	1/8	5/32	3/16	7/32	17/64	5/16	23/64	7/16	19/32	3/4	15/16	1 1/32	1 11/16	2 5/32	3 1/8	4 3/4	—	—
	From	—	1/4	5/16	3/8	7/16	33/64	19/32	23/32	29/32	1 3/16	1 17/32	1 15/16	2 5/8	3 3/4	—	—	—	—
	to	1/4	5/16	3/8	7/16	33/64	19/32	23/32	29/32	1 3/16	1 17/32	1 15/16	2 5/8	3 3/4	5	—	—	—	—

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Table 2—Carbide Tipped Cutoff Tool Capacity (inches)

Material and Form	Thickness Range	Cutoff Tool Thickness (inches)																												
		.040	.045	.050	.055	.060	.065	.070	.075	.080	.085	.090	.095	.100	.110	.120	.130	.140	.150	.160	.170	.180	.190	.200	.210	.220	.230	.240	.250
Stainless																														
	Up to	.18	.22	.25	.28	.31	.34	.37	.41	.44	.48	.52	.56	.62	.72	.82	.94	1.09	1.24	1.43	1.62	1.85	2.10	2.33	2.64	3.01	3.34	3.88	4.50
	Up to	.19	.22	.25	.28	.34	.37	.40	.45	.50	.56	.63	.70	.78	.92	1.06	1.23	1.40	1.60	1.85	2.06	2.36	2.70	3.20	3.75	4.28	4.75	5.25	5.80
	Up to	.18	.22	.25	.28	.33	.36	.40	.44	.48	.52	.56	.62	.70	.81	.93	1.07	1.21	1.39	1.67	1.99	2.32	2.45	2.76	3.15	3.60	4.08	4.60	5.25
	Up to	.30	.36	.42	.48	.59	.67	.76	.87	.98	1.10	1.22	1.39	1.56	1.87	2.19	2.55	2.91	3.56	4.22	4.88	5.56	6.26	7.00	...	...	...	...	...
Steel																														
	Up to	.18	.22	.25	.28	.33	.36	.40	.44	.48	.52	.56	.62	.70	.81	.93	1.06	1.22	1.39	1.67	1.90	2.20	2.48	2.76	3.15	3.60	3.98	4.60	5.25
	Up to	.19	.22	.25	.28	.36	.39	.43	.48	.54	.60	.67	.76	.86	1.01	1.17	1.35	1.53	1.78	2.09	2.34	2.71	3.08	3.73	4.26	4.87	5.44	5.97	6.75
	Up to	.18	.22	.25	.28	.33	.38	.43	.47	.52	.56	.60	.68	.78	.90	1.04	1.19	1.34	1.57	1.91	2.27	2.67	2.83	3.19	3.66	4.19	4.77	5.32	6.00
	Up to	.30	.36	.44	.51	.61	.69	.79	.90	1.02	1.14	1.26	1.45	1.64	1.96	2.30	2.67	3.05	3.74	4.46	5.16	5.91	6.66	7.50	...	...	...	...	...
Brass																														
	Up to	.18	.22	.25	.30	.37	.44	.51	.58	.65	.72	.80	.90	1.02	1.19	1.39	1.62	1.88	2.28	2.70	3.12	3.55	4.01	4.50	5.05	5.60	6.25	...	...
	Up to	.22	.27	.30	.36	.43	.49	.56	.64	.73	.81	.90	1.06	1.23	1.45	1.69	1.93	2.25	2.62	3.05	3.49	3.99	4.51	5.15	5.80	6.50	...	...	...
	Up to	.18	.22	.26	.31	.39	.46	.53	.60	.68	.76	.85	.95	1.09	1.27	1.49	1.75	2.06	2.40	2.80	3.22	3.68	4.20	4.75	5.35	6.00	6.75	...	...
	Up to	.40	.46	.54	.63	.75	.87	.99	1.11	1.23	1.36	1.51	1.71	1.99	2.31	2.72	3.22	3.88	4.48	5.25	6.25	...	...	...	...	...	...	...	...
Aluminum																														
	Up to	.22	.27	.31	.37	.45	.53	.61	.69	.78	.88	1.00	1.13	1.30	1.52	1.80	2.10	2.41	2.80	3.28	3.79	4.35	5.00	5.75	6.75	...	...	...	...
	Up to	.25	.30	.36	.43	.50	.58	.67	.76	.85	.96	1.07	1.23	1.42	1.64	1.92	2.22	2.53	2.93	3.40	3.95	4.60	5.38	6.25	...	...	...	...	...
	Up to	.22	.27	.33	.39	.47	.55	.63	.72	.81	.91	1.03	1.17	1.35	1.57	1.85	2.15	2.47	2.85	3.33	3.85	4.45	5.15	5.95	7.00	...	...	...	...
	Up to	.45	.54	.63	.75	.90	1.05	1.21	1.38	1.57	1.77	2.00	2.30	2.70	3.20	3.84	4.54	5.35	6.20	7.25	...	...	...	...	...	...	...	...	...

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milling cutter approach chart

Lester F. Mulno*

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WHEN THE FABRICATION of metal parts requires a large number of milling operations, tool engineers can save estimating time with the approach chart shown below. The chart quickly shows the distance between the milling cutter centerline and the point on the workpiece where cutting will first start. This distance varies with the depth of cut and the cutter diameter, and is required to determine the over-all length of the milling cut.

The chart is prepared to depict the physical conditions of the approach. The top line of the chart is the centerline of the cutter and the circular arcs represent cutter diameters.

To use the chart, the diameter of the cutter is located on the right-hand vertical scale. The depth of cut is vertically added from this point. The horizontal line representing depth of cut and the arc representing cutter diameter intersect at a point over the correct length of approach.

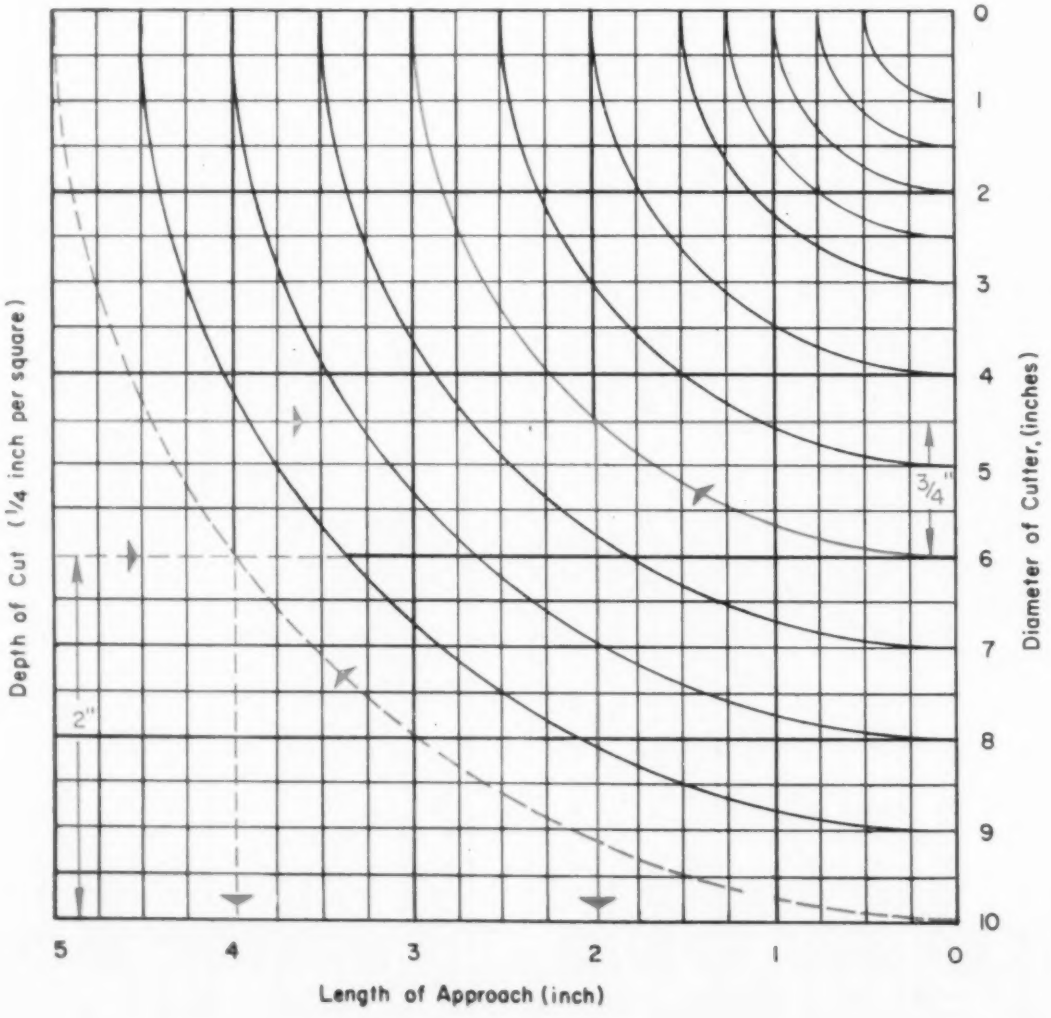
EXAMPLE: It is required to straddle mill a 12-inch part with a 10-inch cutter and a 2-inch depth of cut. What is the minimum length of milling cut?

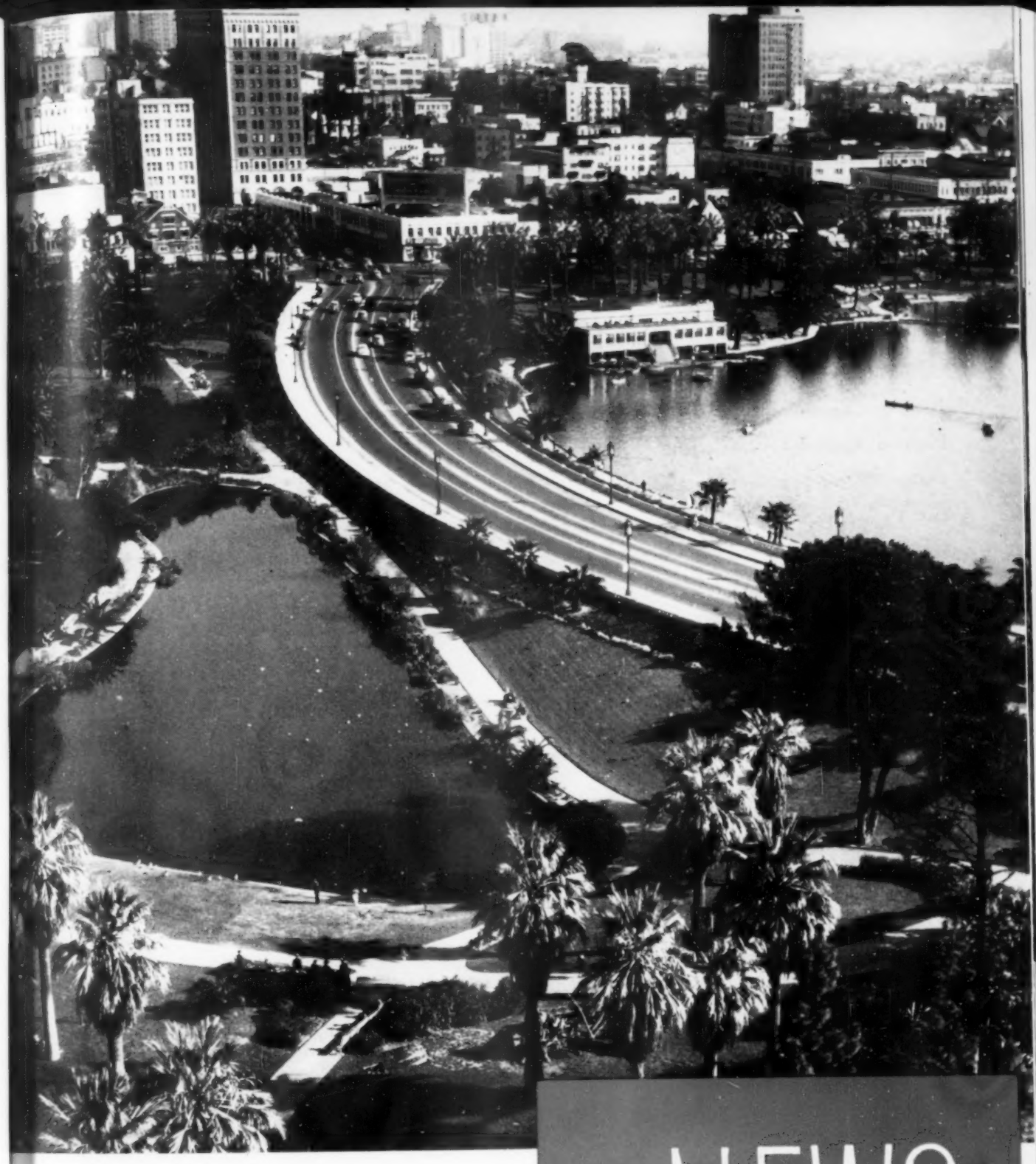
SOLUTION: (dashed lines in color) Reading up from the 10-inch cutter line a distance equal to 2 inches and across to the 10-inch cutter circle indicates an approach of 4 inches. This value added to the length of the part gives the minimum length of cut as 16 inches.

EXAMPLE: For a standard milling, slabbing or slotting operation on a 10-inch part, determine the minimum length of cut using a 6-inch cutter and a ¾-inch depth of cut.

SOLUTION: (solid color lines) Reading up from the 6-inch cutter line a distance equal to ¾-inch and cross to the 6-inch cutter circle an approach of 2 inches is indicated. The minimum length of cut is 12 inches.

*Senior member ASTE Worcester chapter.





LOS ANGELES—host city
for Western Industrial Exposition

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AUTUMN is always a busy season for ASE chapters. The more relaxed pace experienced during the summer months becomes history as renewed technical activities take their place on chapter calendars. From clambakes, golf parties and outings, member attention turns to plant tours, lectures, panel discussions, films and, of course, the important planning sessions so necessary in assuring strong chapters.

THE picture is much the same for ASTE's national committees. While these vital groups can't hold outings and other easy-going events in the summertime, they don't keep up the vigorous tempo maintained during the rest of the year. What autumn means to committee members can best be reported by way of a schedule of national meetings held during a ten-day period in September.

SESSIONS of the Judicial, Honor Awards, Editorial, and Constitution and By-Laws Committees are listed for September 10, with the latter group continuing its meeting on the 11th. Also on the 11th was the selection of candidates by the Annual Nominating Committee. Minutes of the Program Committee show sessions on September 16-17. ASTE money matters were covered by the Finance Committee on September 17 and an agenda including ASTE scholarship awards received the attention of the Education Committee on the 18th. Two days later, the carbide sub-section of the National Standards Committee held a two-day meeting.

MULTIPLYING this listing many times over, adding the work of the national officers and directors, and including activities of 119 chapters reveal a measure of what makes ASTE such a progressive technical society.

ASTE Charters 119th Chapter

Ben Hazewinkel installs officers of the Santa Ana chapter who are: from left, Dave Reichart, first vice chairman; C. D. Small, second vice chairman; T. G. Short, secretary; and L. G. Connelly, treasurer. At the table are Carroll Edson and Len Krow.

Keeping pace with the rapidly expanding industry in California, ASTE's eighth chapter in the state was established when Santa Ana Valley chapter received its charter on August 3. Some 200 were on hand to witness the ceremonies which marked official beginning of activities for the 119th chapter of the Society. The meeting took place at the Clock Country Club in Whittier, Calif.

Chartering officers were National Secretary Wayne Ewing and National Director Ben J. Hazewinkel. Also present were the mayor of Santa Ana, chairmen of all other Southern California chapters and executives from companies represented in the chapter membership.

Election was the first order of business and after the ballots were counted, officers of the new chapter proved to be: chairman—Paul Jones, Jr., superintendent at Northrup Aviation, Long Beach; first vice chairman—David Reichart of North American Aviation, Downey; second vice chairman—Clarence D. Small, superintendent at Kwik-Set Lock, Inc., Anaheim; secretary—Thomas G. Short, buyer for Northrup Aviation, Anaheim; and treasurer—LeRoy G. Connelly, owner of Connelly Machine, Santa Ana.

Newly elected officers were installed by Ben Hazewinkel, and Wayne Ewing presented the charter and chairman's pin. Both national officers talked to the group about ASTE's rapid growth and future plans of the Society.

Louis Polk Host to Research Committee Members

Broadened industrial participation in projects of the ASTE Research Fund Committee is being invited as a result of action taken at the committee's most recent meeting held on August 14 and 15.

Companies may now take part in ASTE research projects by one or several of the following methods: extending financial aid; appointment of company personnel to serve on steering committees; sharing present knowledge; and undertaking projects to be carried out in company laboratories to be reported to the committee.

The summer business session was held at the lodge of one of the committee members, Louis Polk, at Echo Island in McGregor Bay, Ontario, Canada. Highlighting the two-day meeting was the presentation of the committee's resolution to Frank Wilson, in appreciation for his work as acting research director while still carrying out his responsibilities as technical director and book editor for ASTE.

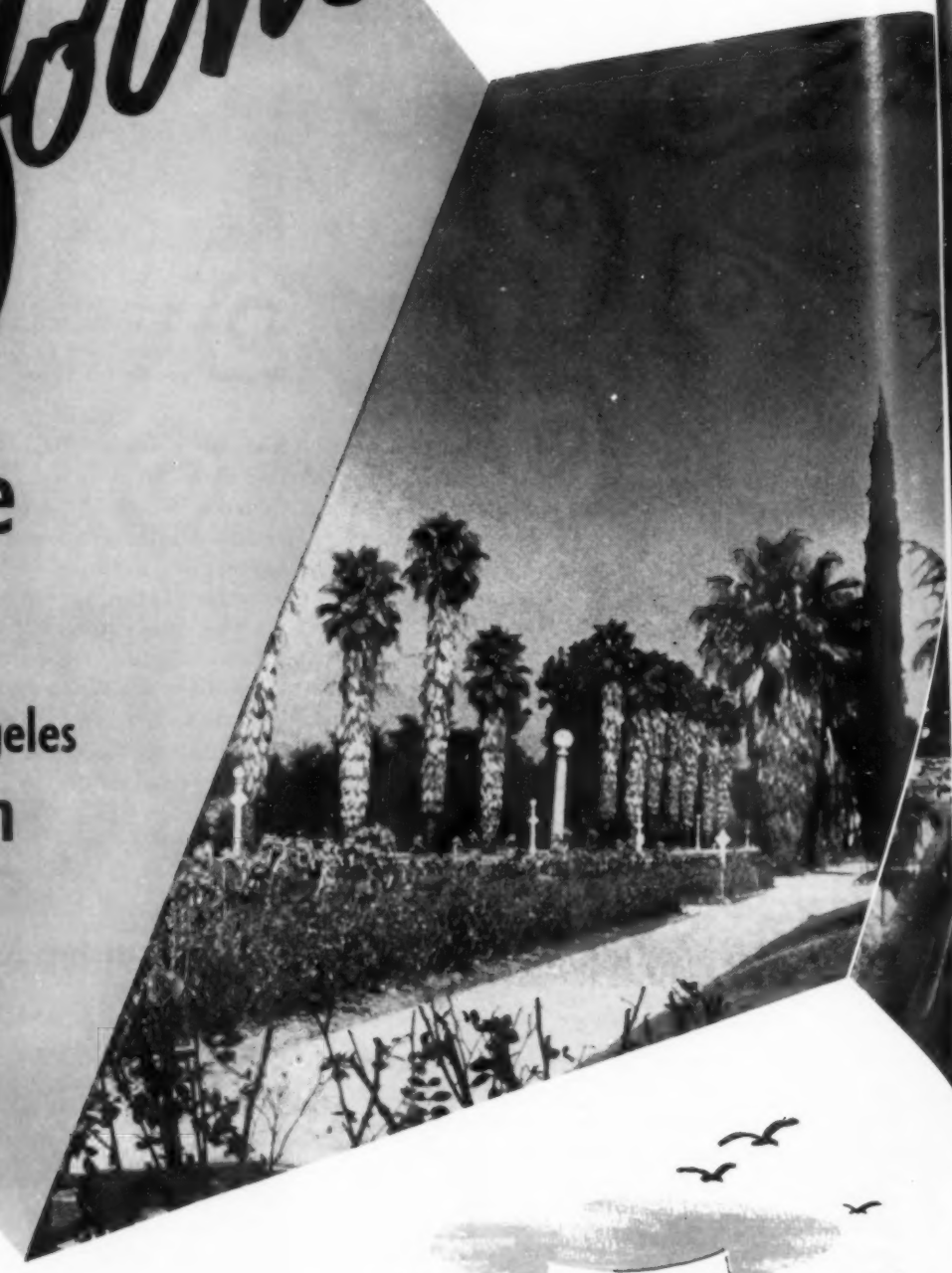
Chairman Robert Douglas, right, presented the committee's certificate of appreciation to Frank Wilson for his fine work as acting research director.

To express its appreciation to the Society for the loan of Mr. Wilson's services, the committee presented a copy of the resolution to ASTE President Joseph P. Crosby.

California

welcome

waits for visitors to ASTE's Los Angeles exposition

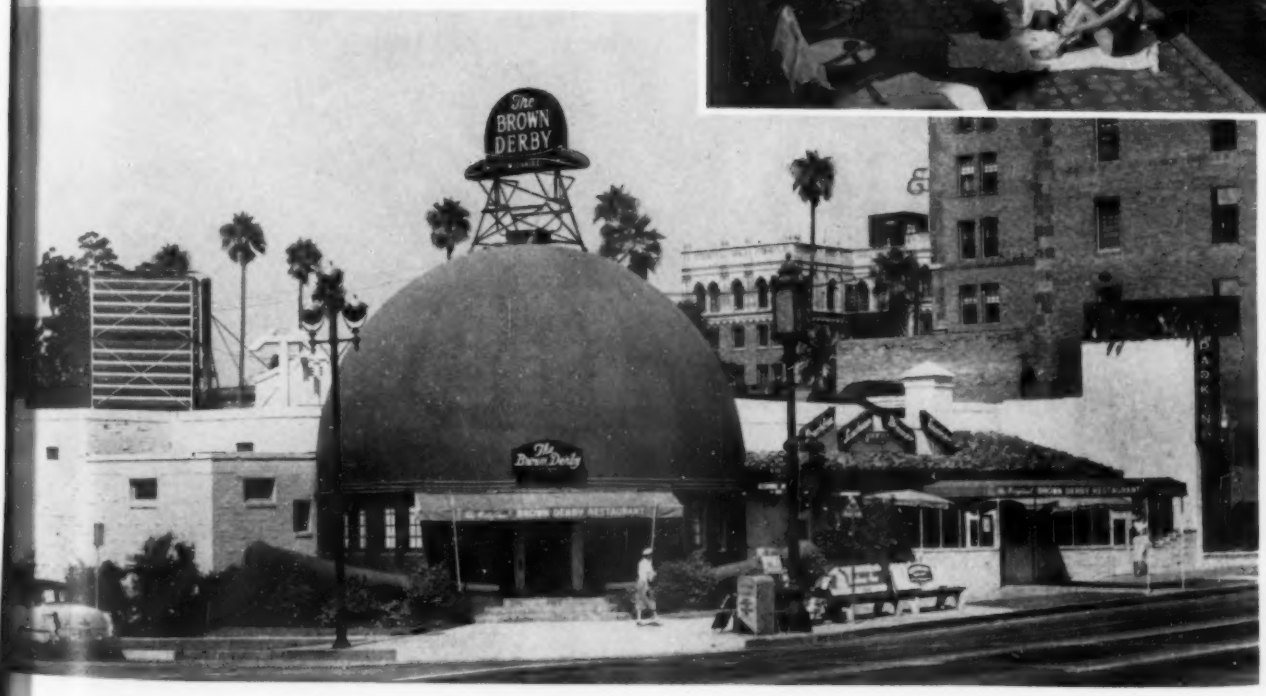


By Nancy Morgan Houston
News Editor

Attending the 1955 Western Industrial Exposition in Los Angeles next March will afford ASTE members the perfect opportunity to combine a week of technical exhibits and discussions with vacation time in a state known for an exciting variety of things to do. California's colorful cities, scenic attractions and full range of recreation facilities guarantee vacation activities to suit the whole family.

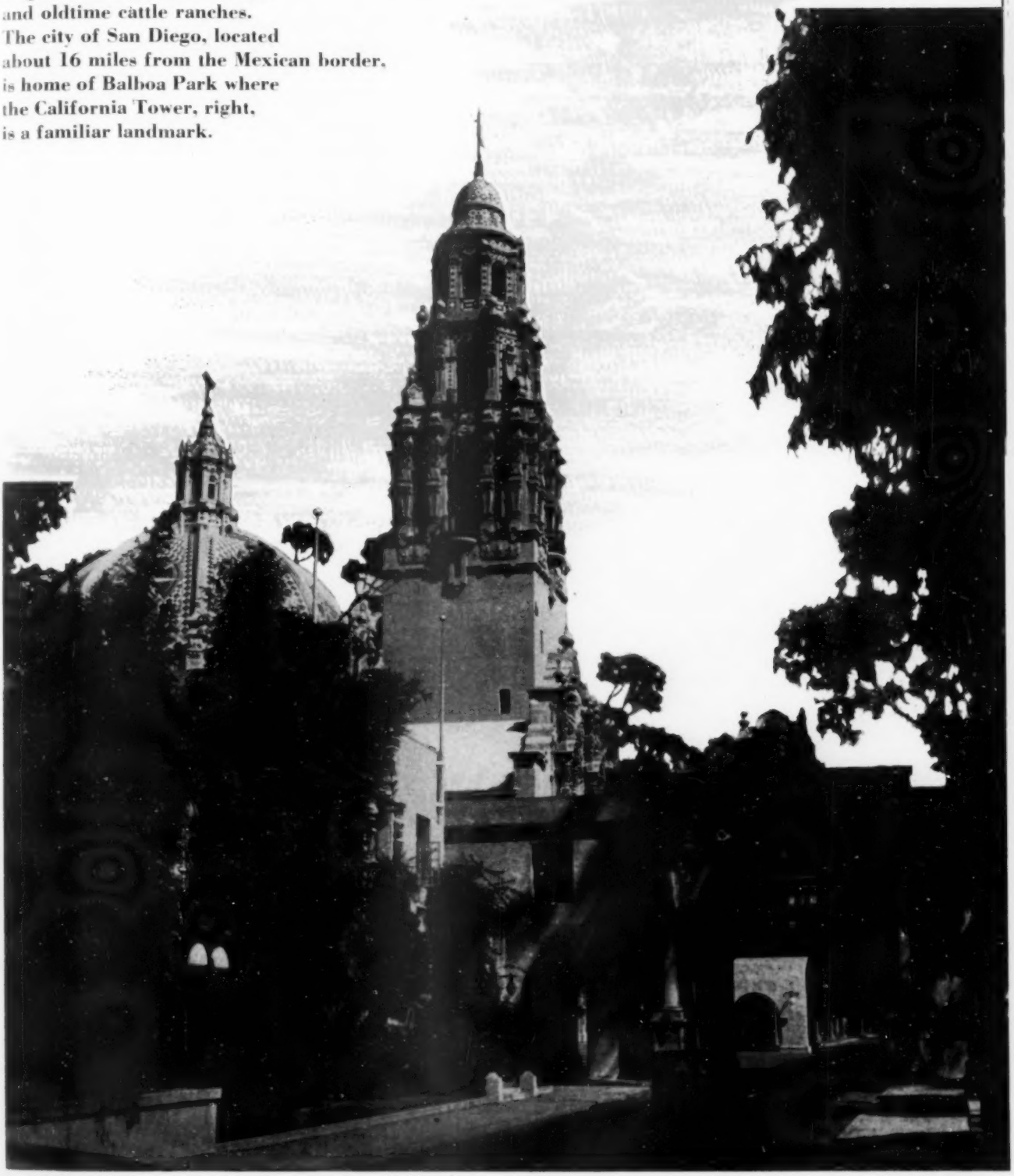
Los Angeles, pictured above in a dramatic night scene, will serve as headquarters for ASTE visitors in California for the Exposition. More than the movie capital of the world, Los Angeles is also the fourth largest city in the nation, with a vast industrial production and a seaport second only to New York in exports.

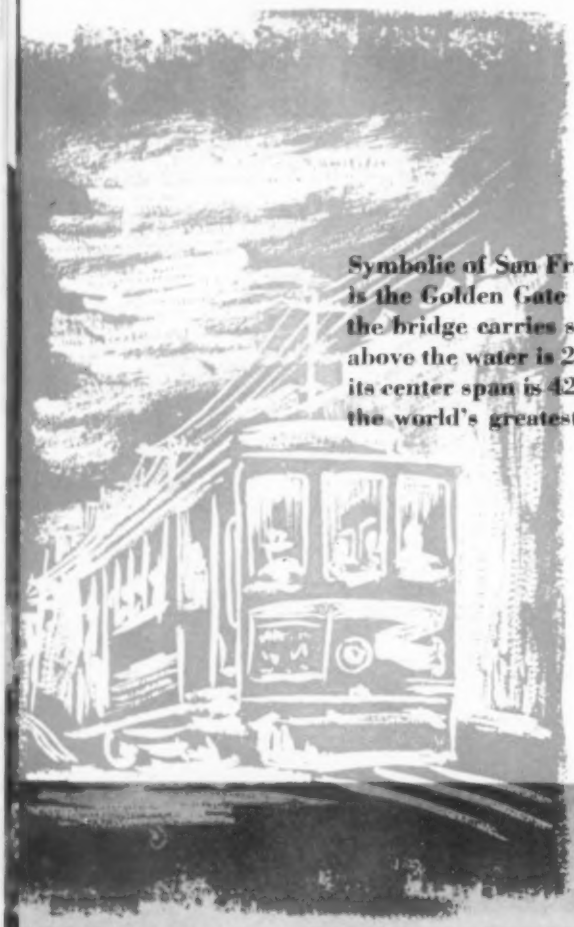
Ten hotels in the Los Angeles area are setting aside blocks of rooms to accommodate ASTE convention goers. Society headquarters during Exposition week will be located at the Ambassador where the Sun Club, right, is a major attraction for hotel guests. The original Brown Derby Restaurant, below, located on Wilshire Boulevard, is known for its celebrities and attracts thousands of tourists every year.



Hollywood Bowl, above, is hub of concert activity and brings music under the stars to huge outdoor audiences. Studios of the Columbia Broadcasting System, right, and other radio and television networks provide tickets for most shows originating from Hollywood. Nearly all motion picture companies offer daily conducted sight-seeing tours. Other popular points of interest in and around Los Angeles include: homes of movie stars in Beverly Hills and Santa Monica, Farmers Market, the California International Flower Show held during March, Santa Catalina Island, and numerous parks, beaches and old Spanish missions.

A short trip south of Los Angeles
takes visitors to San Diego County,
a unique combination
of modern cities and quaint old mining towns;
of gentleman farmers' estates
and oldtime cattle ranches.
The city of San Diego, located
about 16 miles from the Mexican border,
is home of Balboa Park where
the California Tower, right,
is a familiar landmark.

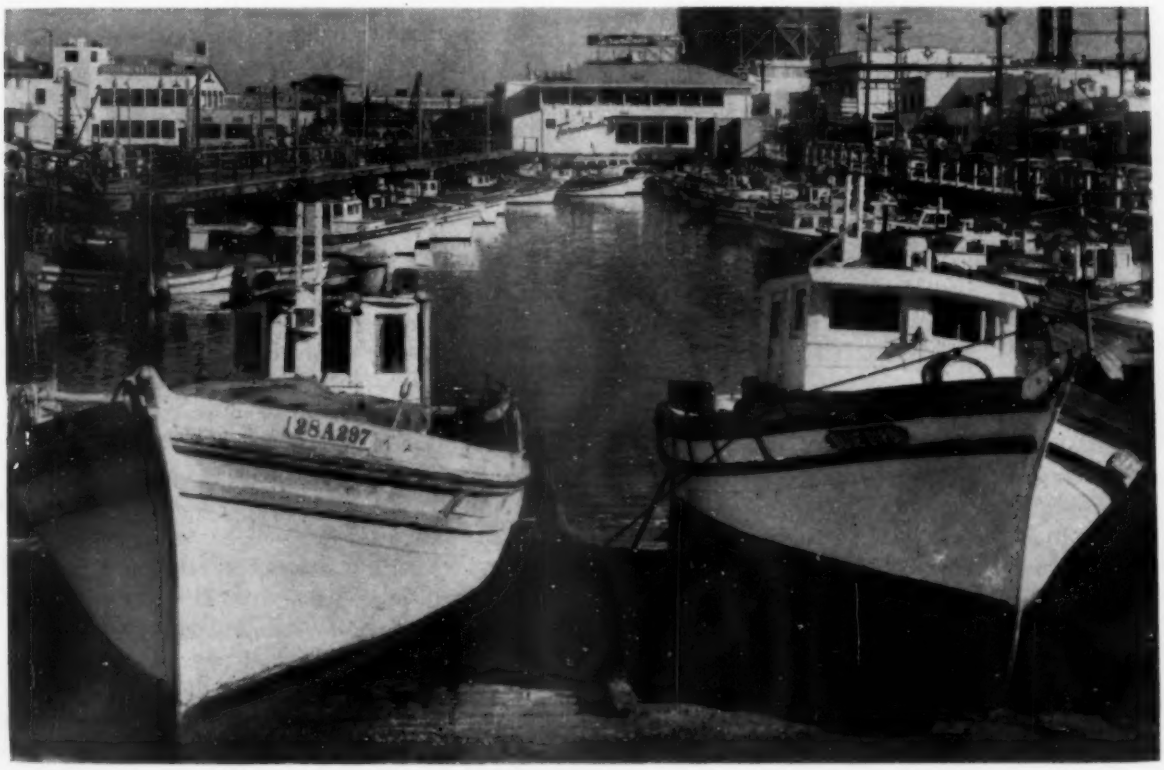




Symbolic of San Francisco, one of the country's most cosmopolitan cities, is the Golden Gate Bridge. Spanning San Francisco Bay, the bridge carries six lanes of automobile traffic. Its clearance above the water is 220 feet; its towers are 746 feet high; its center span is 4200 feet long—on all counts, the world's greatest bridge.

San Francisco's Chinatown, right, which is near the downtown hotel, theater and shopping district, is the largest community of its kind outside the Orient. With its shops, bazaars, temples, night clubs and restaurants, it is by day and by night a source of endless interest for visitors and San Franciscans alike. Fishermen's Wharf, below, is a series of piers and lagoons with hundreds of fishing boats, and adjacent streets of sea food restaurants with steaming cauldrons along the curbs in which the famous large local crabs are cooked.

The helpful cooperation of Californians, Inc., Union Pacific Railroad and United Airlines in supplying photographs of California is gratefully acknowledged.



Programs Announced for ASTE Conferences at Four Universities

Proving the increasing popularity of on-campus conferences, ASTE chapters in Wisconsin, Iowa, Pennsylvania, Ohio, Michigan and Ontario have announced programs for meetings taking place in October and November. The conferences are sponsored jointly by the chapters, universities and the ASTE National Education Committee.

Madison members are planning their third annual tool engineering institute at the University of Wisconsin on October 20-22. The Cedar Rapids chapter, in cooperation with the Des Moines and Tri-Cities chapters of ASTE, will hold its first engineering conference on November 13 at the State University of Iowa at Iowa City.

That same day several hundred miles away at Lehigh University, Bethlehem, Pa., Pennsylvania chapters, headed by Lehigh Valley, also will hold their first on-campus conference.

A week later on November 20, the second tool engineering conference at the University of Michigan in Ann Arbor will be sponsored by the Ann Arbor, Detroit, Toledo, Windsor, Saginaw Valley, Pontiac, and Jackson chapters as well as the University of Michigan student chapter.

University of Wisconsin

The three-day tool engineering institute at the University of Wisconsin, will be highlighted by the Madison ASTE chapter dinner on October 21. Registration for the entire program will be held Wednesday morning at 8:30 at the New Engineering Building.

Welcoming the group at the first session will be Paul J. Grogan, director of engineering institutes for the university. Technical sessions that day will cover die design techniques on die making. The plant tour through the Kipp Corp. will be followed by a talk by the firm's vice president, Art Lillegren, who will discuss techniques in die casting.

October 21st sessions will open with a talk on "Research Development on Hi-Speed Machining" by William O. Moeser, patent attorney, Jones & Lamson Machine Co., Springfield, Vt. "Methods Improvement Fundamentals" will be reviewed by R. W. Truxell, Oldsmobile Div., General Motors Corp., Lansing, Mich.

J. J. Jaeger, chief engineer of Pratt & Whitney Div. of Niles-Bement-Pond Co., Hartford, Conn., will speak on "Tracing Attachments."

Friday sessions will feature talks on "Surface Measurement Techniques" by a representative of The Sheffield Corp., Dayton, O.; "Selection of Materials for Tooling" by R. H. Boettger, plant metallurgist, Columbia Tool Steel Co., Chicago Heights, Ill.; and a "Summary of What's New in Materials and Processes."

State University of Iowa

Joining forces with the ASTE chapters in sponsoring the engineering conference November 13 at the State University of Iowa are three other engineering groups in the state. Cooperating in the project are the Quad Cities Time-Study Engineers, Central Iowa M. T. M. Association, and the Industrial Engineers Association of Iowa.

With "Controlling the Immeasurable" as its theme, the conference will be a one-day seminar slanted toward management men, foremen and superintendents. Speakers will be top management men from midwestern industry and professors from the State University of Iowa and Purdue University, Lafayette, Ind.

Topics to be discussed will cover: memo motion as applied to tool and die shop operation; direct

The planning committee for University of Iowa's first annual engineering conference discusses plans and details for the program. Seated, from left, are: Ronald L. Walder, Morton A. Blum, Prof. Wayne Deegan, Robert Weinhardt, and Carroll F. Bryant. Standing are: H. I. Metee and Julian Vercoutere.

observation and synthesis in connection with maintenance department operations; work sampling as a means of evaluating your supervisors: control of fixed costs; and control of indirect operating costs.

Lehigh University

A full day of activities is planned for the on-campus conference at Lehigh University. In addition to the technical sessions, a complete ladies' program, a luncheon meeting, and a banquet are on the agenda.

The morning will be devoted to a panel discussion on foundry practice. Chairman of the session will be Truman Coy and moderator will be Bart Diamond.

Other panel participants are: William Thomas, vice president of Emmaus Foundry and Machine Co., Emmaus, Pa., who will talk on shell molding; Herman Goode, plant manager of Reading Textile Machine Co., Reading, Pa., who will discuss automation and sand casting in the foundry; W. T. Marshall, superintendent for the Doehler-Jarvis Division of the National Lead Co., Pottstown, Pa., on die casting; and Max Wendt, vice president of engineering, Arwood Precision Investment Casting Co., Brooklyn, N. Y., on investment casting.

The noon luncheon will be held at Lambertown Hall on the Lehigh campus. Featured speakers will be Dr. Harry B. Osborn, Jr., first vice president of ASTE; and Arthur Gould, head of the department of industrial engineering at the university.

Three concurrent sessions will be held in the afternoon. R. F. Pearse, senior associate of Worthington Associates in Chicago, will speak on "A Program for Developing Tool Engineers into Manufacturing Executives." J. Y. Riedel, tool steel engineer, Bethlehem Steel Co., will discuss "Improving Production through Tools and Dies." The speaker who will present the session on "Uses of Plastics in Tooling" has not yet been announced.

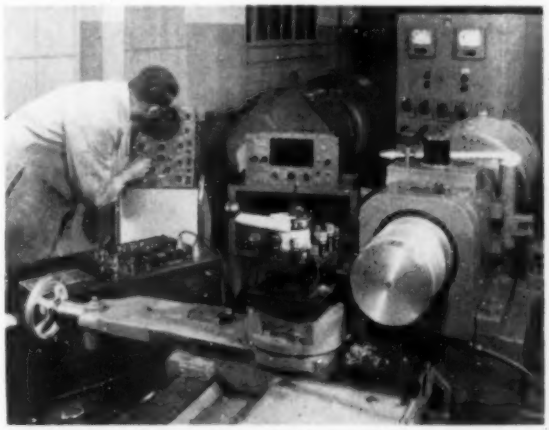
At the evening banquet, A. C. Bodine, president of the Bodine Corp. at Bridgeport, Conn., will address the tool engineers and their wives. His subject will be "The Value of Tool Engineers to Industry."

University of Michigan

Theme for the conference at the University of Michigan on November 20 will be "Planning for Tomorrow's Cost Reduction." To accommodate everyone who wants to attend sessions at Ann Arbor, advance registration is urged by members of the planning committee and may be arranged by writing to Marland B. Small, supervisor of institutes, Extension Service, University of Michigan, 4501 Administration Building, Ann Arbor.

Opening the conference will be demonstrations and tours in the production engineering laboratories. Included will be: high-speed machining; electrospark machining, ultrasonic machining, applied machinability; shell molding and precision casting; and vacuum melting.

Lectures on these topics will be given by Prof. O. W. Boston, head of the department of production engineering at the university; Dr. W. W. Gilbert, General Electric Co.; Prof. R. A. Flinn, university department of production engineering; John Bernard, vice president of Sheffield Corp.; Prof. John Datsko and Prof. L. V. Colwell, both of the university department of industrial engineering.



This lathe will be operated as part of a demonstration of high speed machining at the Michigan conference.

Other sessions will feature talks on "Economics of Equipment Replacement" by Charles Clarke, Cincinnati Milling Machine Co., Cincinnati, O.; and "Automation" by Charles Hautau, head of Hautau Engineering Co., Detroit, Mich.

A coffee hour and an evening banquet will wind up the day's program.

Santa Clara Members Tour Fiber Glass Plant

Approximately 60 members of the Santa Clara Valley chapter toured the Owens-Corning Fiberglas Corp. in Santa Clara on August 17. Program Chairman Bill Forbes introduced James W. Braddock, industrial relations manager, to the group and he welcomed them on behalf of Fiberglas.

In turn, three representatives of the company explained their particular phase of operation. Speakers were: John Vyverberg, San Francisco sales branch manager; Gil Falling, production engineer; and R. M. Diass, production superintendent.

After the briefing, the tour was made by groups of five, each with its own guide to answer questions. The whole operation was viewed from unloading of raw material at the railroad siding to the finished product in the warehouse. *—Harold Weaver*

Rochester Officers Meet with Charles Smillie

An executive committee meeting gave officers of the Rochester chapter an opportunity to meet and get acquainted with National Director Charles Smillie. The meeting was held at the Liederkranz Club on August 9. It was decided that because of the popularity of panel discussions and plant tours during the past year, there would be more of that type of activity on this year's technical program.

On July 20, the monthly executive meeting was held at the home of Van Buren Hansford on Canandaigua Lake for a combination business and pleasure get-together.

—Paul A. Bruno

DENVER OFFICERS—Past chairman "Jeff" Geoffroy installs officers who will lead the Denver chapter during 1954-55. They are from left: Clint Helton, national delegate and retiring chairman; Clyde Elliott, treasurer; Preston Ward, secretary; George Buckel, second vice chairman; Norvill Allen, first vice chairman; and Willard Krieger, chairman.

Golden Gate Again Offers Tool Engineer Courses

Golden Gate chapter is again sponsoring two tool engineering courses, starting in the fall. Co-sponsor is the Laney Trade & Technical Institute in Oakland, Calif.

"Fundamentals of Tool Engineering," taught by Henry De Coursey, and "Mechanical Drawing and Tool Design," taught by Louis Talamini, are offered.

Springfield Chapter Holds Annual Fish Fry

The Lions Club was the scene of the Springfield, Ill., chapter's annual fish fry on August 6. The eighty guests who attended were lavish in their praise for LeRoy Rasch who was chairman of the event. The menu was highlighted by catfish and the evening was one of fellowship.

—Charles Collier

Position Wanted

EXPERIENCED CUTTING TOOL REPRESENTATIVE—located in southwest, 18 years' shop and sales experience, desires similar position. Will consider relocating. Write to Box 001, News Department, The Tool Engineer, 10700 Puritan, Detroit 38, Mich.

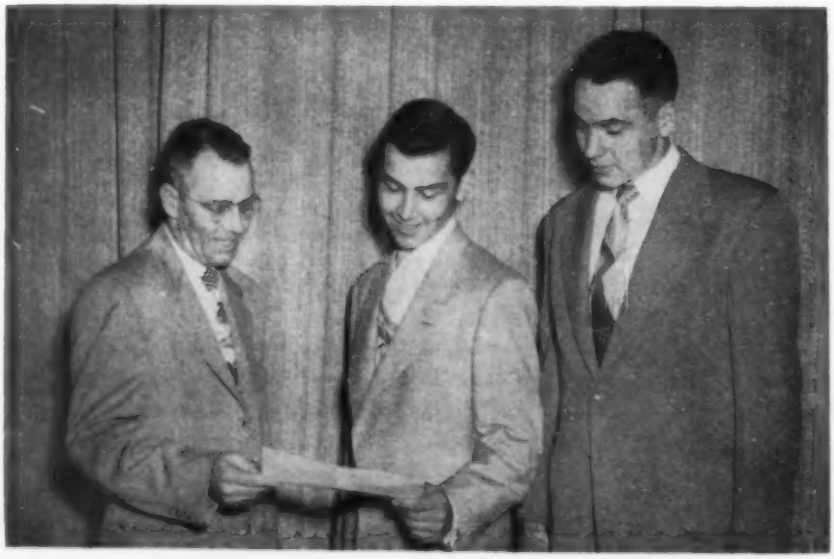
Northern Mass. Chapter Awards Two Scholarships

Northern Massachusetts chapter inaugurated an extensive educational program during the past year. They have concentrated on increasing the capabilities of people now employed in industry. A total of 130 now employed in local industry have spent last winter studying such courses as hydraulics, pneumatics, electricity, and mathematics.

The facilities to provide this instruction are furnished by the chapter without charge to the student or industry. Because of the success of last year's program, the chapter plans to expand the training program next year.

The chapter also reports that the meeting attendance record among its 210 members has maintained an average of 75 percent during the two years since its formation.

The chapter's second annual outing was held June 19 at the Ellinwood Country Club in Athol. Under the direction of Outing Chairman Harold Moss, golf, softball, ping-pong, darts, horseshoes and other athletic activities, were on the program. *—Otto S. Nau*



SCHOLARSHIP WINNERS — George A. Stanley, chairman of the Northern Massachusetts education committee, presents awards of $250 to, from left, Thomas R. Danielson of Baldwinsville, Mass., and Hubert A. Loretan of Athol, Mass.

Past President Smila Retires from Chrysler

After 27 years at Chrysler Corp., William H. Smila, past president of ASTE and staff specialist at Plymouth Division in Detroit, retired the first of August.

On the industrial scene for 40 years, he started out in a shop, and later served as a tool designer and tool engineer. He was named chief tool engineer of Chrysler Division's Jefferson plant in 1927 where he subsequently became master mechanic in 1933. He was transferred as master mechanic to Chrysler's Plymouth Division in 1940. Ten months ago he was named staff specialist at that plant.

W. H. Smila

One of ASTE's charter officers, Mr. Smila was the first vice president when ASTE was formed in 1932. The following year, second of ASTE's existence, he was elected president of the Society. In his long service to ASTE, he has also held chairmanship of the National Membership and Standards committees, as well as offices in the Detroit chapter.

New Plans for Detroit Bulletin

Gregg Manchester, editor of *The Toolcast*, Detroit chapter's monthly news bulletin, has announced new plans for the publication starting in the fall. It will be published in color. Red, blue, yellow and green are proposed and one color will run each month.

Another announcement is of two Detroit chapter members, Norm Hopwood and Tom Jeffries, who have been appointed chairman and secretary, respectively, of Ford Motor Company's "Carbide Applications Sub Committee."

—Walter Schober

New Company Formed

Announcement has been made of the formation of the Joliet Tool & Manufacturing Corp., in Joliet. The company is headed by Henry G. Wasserlein, president, with Clifford W. Berglund as vice president and general manager; M. J. Polley as production manager; and E. J. Querio, toolroom foreman. All four are members of the Louis Joliet ASTE chapter and Mr. Berglund is currently chairman of the education committee.

APPLIED MACHINABILITY CONFERENCE—Representing tool engineer chapters in various parts of the United States, these men met at the University of Michigan, Ann Arbor, Mich., to study machinability from August 2-13. They are, front row from left: E. W. Hurd, Jr., W. J. Carter, Prof. Joseph Datsko, R. D. Kludt, H. A. Fletcher, Major J. Y. C. Roth, and Prof. L. V. Colwell. The second row includes: G. P. McCleary, C. A. Davis, E. M. McCullough, John Uberbacher, W. W. Dodson, P. A. Mongerson, Jr., R. S. Kaczmarek, and W. L. Moore. Standing are: H. C. Webb, J. P. Wickel, E. S. Sipek, P. R. Visser, Vincent Zimpfer, A. E. Woodward, Jr., and K. F. Packer. *—L. V. Colwell*

San Fernando Observes Second Anniversary

The August 4 meeting of San Fernando Valley chapter marked its second anniversary. Some 108 members and their wives met at Hody's Restaurant in North Hollywood, Calif. to observe the occasion.

Guest speaker was Charles Girvin, area staff assistant, Pacific Telephone and Telegraph Co., North Hollywood. The talk, though technical, was presented and demonstrated so clearly, that even the ladies were enthusiastic.

On the lighter side, Al Stollicker entertained the group with humorous stories about his family life. The ladies wore flowers from Hawaii.

—A. J. Soares

Optical Tooling Panel on Los Angeles Agenda

Optical tooling and its uses was the subject of a six-man panel discussion presented for the Los Angeles chapter at Scully's Restaurant on August 12. More than 250 members and guests turned out for the meeting.

Panelists were: Verne G. Olson of Lockheed Aircraft Co.; Roy Helser of Keuffel & Esser; Kenneth M. Olson and K. H. Boucher of Douglas Aircraft Co.; James M. Stols of Opto Engineering; and Frank Lamphere of North American Aircraft Co. The use of optical tooling in inspection and major jig building was stressed by the panel. *—John A. Boettgenbach*

Design Completed for Past Directors Awards

Under the supervision of ASTE's Honor Awards Committee, a completed drawing has been made of the design for the emblem to be used on the past directors' awards. To be offered optionally as lapel pins or tie clasps, the awards have been approved by the Board of Directors and will be presented to all past directors during the next few months.

On the list of recipients are several ASTE members who participated in early Society board meetings but whose records have been lost. Their names appear in some of the proceedings of these meetings, but it is not indicated whether they were board members or members-at-large.

To locate these men and to make certain everyone who is entitled to the award receives one, the following list is published with the hopes that Tool Engineer readers may know of their whereabouts. The years designate when the names appeared on minutes of board meetings.

C. W. Barber, 1941-42; F. M. Gertiser, 1935-36; E. C. Lee, 1933-34; E. C. Mack, 1942-43; E. M. Taylor, 1940-41; H. C. Taylor, 1938-39; and Adolph Zaborowski, 1940-1941.

Any information which might be of help in bringing the records up to date can be forwarded to the Honor Awards Committee, ASTE National Headquarters, 10700 Puritan Ave., Detroit 38, Mich.

coming ASTE meetings

BATTLE CREEK—Oct. 11. "Fluid Power in Action" by Harry Stewart, assistant sales manager of Logansport Machine Co., Logansport, Ind.

CEDAR RAPIDS—Oct. 26, 6:30 p.m., Montrose Hotel, Cedar Rapids. Joint city-wide meeting with Industrial Engineers Association, National Association of Cost Accounting and American Society for Metals. "Equipment Obsolescence and Replacement" by a representative Machinery and Allied Products Institute, Chicago.

DETROIT—Oct. 7, 8 p.m. Carbide meeting. "Future Requirements of Carbides" by Harold Inch. Oct. 14, 6:30 p.m. Plant tour of Cross Machine Co., Detroit. Oct. 27, 7:30 p.m. Rackham Building. "Operation and Theory of Metalworking" by E. V. Crane of the E. W. Bliss Co., Canton, Ohio.

EVANSVILLE—Oct. 11, 6:30 p.m., Joint meeting with American Society for Quality Control. "Precision Measurement and Quality Control" by John Harrington.

FORT WAYNE—Oct. 13. Slides in 3-D on Mercast Process, shown by representative of Alloy Precision Co.

GRANITE STATE—Oct. 19. "Spark Machining" by a representative of the Elox Corp.

HAMILTON — Oct. 15, Fisher Hotel, Hamilton. "New Developments in the Abrasive Field" by A. L. Ball, director of research, Bay State Abrasive Products Co., Westboro, Mass.

HARTFORD — Oct. 11. Hotel Statler. "Hartford Night."

LEHIGH VALLEY—Oct. 16. Plant tour of Grumman, Long Island.

LIMA—Oct. 21, 6:30 p.m., Legion Hall, New Bremen. Meeting followed by two plant tours of Stampco, Inc., New Bremen; and of the Minster Machine Co., Minster.

LITTLE RHODY—Oct. 7, 6 p.m., Johnson's Hummocks. "Optical Gaging" by a representative of Optical Gaging Products, Inc., Rochester, N. Y.

LOUIS JOLIET — Oct. 19, 6:30 p.m., Woodruff Hotel. "The Techniques of Micro-Drilling" by J. A. Cupler II, general manager, National Jett Co.

MILWAUKEE—Oct. 14, 6:30 p.m., American Serb Memorial Hall, S. 51st St. and Oklahoma Ave. "U. S. Multi-Slides Automatic Cutting, Piercing, Forming and Assembling" by A. Melick, chief tool engineer and sales consultant engineer, U. S. Tool Co., Inc., Ampere, N. J.

NEW HAVEN—Oct. 14. Plant tour of New England Die Casting Co.

NORTHERN NEW JERSEY—Oct. 12, 8 p.m., Hotel Robert Treat. "Automation—as Applied to the Aircraft Industry" by Paul M. Walla, production master mechanic, Wright Aeronautical Div., Curtis Wright Corp.

NORTHERN MASSACHUSETTS—Oct. 19, 7 p.m., Memorial Hall, Athol, Mass. "Why the Stress on Human Relations in Industry?" by Frank Zacher, director of personnel, Norton Co.

PHILADELPHIA — Oct. 21. "Ultrasonic Machining" by George Brown of Sheffield.

ROCHESTER—Oct. 4. Tour through new Delco Plant, Division of General Motors. Dinner before tour in plant cafeteria.

SAN FERNANDO VALLEY—Oct. 6, 7 p.m., Hody's Restaurant, North Hollywood. Calif. "What's New in Grinding" by Robert Gibbs Van Keuren, manager and sales engineer, Norton Co.

SANTA CLARA VALLEY—Oct. 19, 7:30 p.m., "What Is New in Grinding?" by R. G. Van Keuren, manager and sales engineer, Norton Co.

SOUTHEASTERN MASSACHUSETTS — Oct. 19, Taunton. "Meehanite Castings" by C. E. Harrington of Meehanite Corp., New Rochelle, N. Y.

TOLEDO—Oct. 15. "More Production through Motion Study" by Harold Amrhein, associate professor at Purdue University, Lafayette, Ind.

TRI-CITIES—Oct. 13, 6:30 p.m., Tour of Clinton Machine Co., Maquoketa, Iowa.

Six Hundred Expected for Hartford Night

Always one of the outstanding events of the year for the Hartford ASTE chapter is "Hartford Night." Scheduled this year for October 11, it is expected to draw a crowd of nearly 600.

As an added attraction it is to be held in the Capitol Ballroom of the recently completed $5.2 million Hartford Statler, one of the world's most modern hotels. Actually, ASTE Hartford Night will mark the first meeting of a technical society in that hotel.

Speaker on the evening program will be Jacob J. Jaeger, chief engineer of Pratt & Whitney Division, Niles-Bement-Pond Co. in West Hartford, Conn. His subject will be "Pros and Cons of Automation."

—A. Douglas Proctor

Twin Cities Secretary Killed in Plane Crash

Major Louis M. Walton, secretary of the Twin Cities chapter, was killed in a plane crash near Forest Lake, Minn., on June 27. Shop superintendent at Lloyd Products, Inc., St. Paul, he had served as membership chairman, program chairman, treasurer, and on various chapter committees. He was very active in chapter programs and the members of the chapter feel they have suffered a great loss.

—Walter J. Comstock

Society Board to Hold Semiannual Meeting

ASTE's Board of Directors will hold a two-day meeting October 25-26 at the Statler Hotel in Detroit where it will review the semiannual reports of the various ASTE national committees. A social highlight of the meeting will be a dinner on the 25th in the Ivory Room at the hotel.

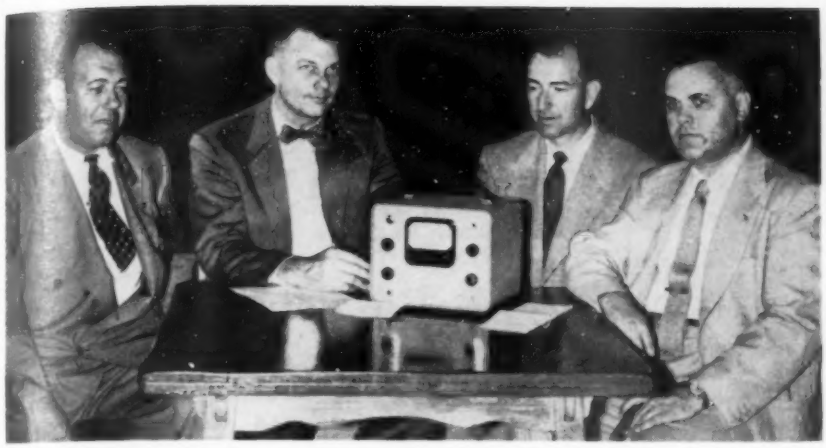
Position Available

CHIEF ENGINEER—Medium-size, nationally known, midwestern company, located in large metropolitan area, is seeking the services of a man qualified to eventually assume the duties and responsibilities of Chief Engineer. This long-established company manufactures multiple spindle, special purpose, high production drilling, reaming, tapping, boring and milling equipment for the mass production industries.

Man who seeks to qualify should be between the ages of 38 and 45 years and have a minimum of 6 years' experience in detail, layout, design and checking of special-type multiple spindle equipment. Applicant should possess executive and administrative abilities, as well as technical skills. He should have the ability to lead men and teach beginners, plan and schedule work, have a desire for design and organization modernization with a view toward cost reduction.

Immediate replacement would be as head of drafting room and as understudy for Chief Engineer. Company offers all standard employee benefits and an excellent opportunity for future advancement in salary and position.

Please describe in full all previous experience, present position, starting salary required and personal data. Men who appear to quality will be brought to manufacturer's plant at company's expense. All replies will be in the strictest confidence. Write to Box 002, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.



SAN GABRIEL PROGRAM—Speaker at San Gabriel Valley's July 1 program, H. E. Burke, second from left, shows vibration measuring instruments to Chairman Irving Greensides, left, Ed Cutler first vice chairman, and Lincoln Mager, right. Mr. Burke, from Consolidated Engineering Corp., spoke on "Vibration and Its Measurement."

Lima Chapter Plans Refresher Courses

E. R. Wagner, chairman of the Lima professional engineering committee, is busy planning a six-week refresher course in mechanical and electrical engineering. It has been set-up to help those who want to pass the 1955 state examinations which are required for becoming a registered professional engineer in Ohio.

The course will be offered by Ohio Northern University of Ada with classes held in Lima. —*Donald Cox*

C. E. Gaffney Promoted

C. E. Gaffney of the Lima ASTE chapter and superintendent of manufacturing at the Lima Division of Westinghouse Electric Corp., has been named superintendent of the company's new plant in Upper Sandusky, Ohio.

Social Event Tops Long Beach Calendar

Members, guests and friends of the Long Beach chapter turned out 490 strong for the chapter's annual smoker and social on August 20. This very successful event took place at the American Legion Hall, Santa Ana, Calif. —*C. W. Ward*

Potomac Member Honored

Thomas F. Protz, a member of the Potomac ASTE chapter, was honored at a ceremony held recently at the Diamond Ordnance Fuze Laboratories, Washington, D. C., when he received a certificate of achievement for his personal contributions in shop operations. The laboratories are an Army ordnance installation of the National Bureau of Standards where basic research and development of fuses and fusing is carried on.

Precision Chucking on San Gabriel Program

Two informative talks highlighted the August 5 meeting of the San Gabriel Valley chapter and nearly 100 members attended.

The first portion of the program was presented by Carl E. Johnson, direct factory representative of N. A. Woodworth Co., Detroit. He showed a slide sound film which portrayed the close accuracy attainable through the use of diaphragm chucks.

The second speaker, George A. Groom of Micromatic Hone Corp., presented a colored film entitled "The Generation of Metallic Bearing Surfaces." Of particular interest was the equalizing diametric pressure exerted by the honing stones as well as the self-dressing action of the stones.

Both speakers answered questions in the open discussion which followed.

—*J. S. Wajdik*

Twin Cities Sets up Scholarship Program

At an executive meeting of the Twin Cities chapter on August 19, officers and committee men established an annual scholarship award program. They decided to present separate scholarships of $100 each to three schools. Recipients will be University of Minnesota, St. Paul Vocational School and Dunwoody Industrial Institute.

Present and accounted for at the meeting held at Farwell Metal Fabricating Division of Farwell, Ozmun, Kirk & Co., in St. Paul, were: Chairman Jerome Schwartz, Philmore Armstrong, C. Eric Fasth, Arnold Schering, Walter Comstock, Norman Sorlie, Robert Wressell, and Gerald Oppel.

—*Walter J. Comstock*

ANNUAL SPLASH PARTY—Members of the Tucson chapter, their wives and guests gathered at the El Conquistador Hotel, East Broadway, for their annual splash party and buffet supper. Watching festivities, at left, are: Mr. and Mrs. Roland Mottar and Mr. and Mrs. Al Hanson. Pictured at the right are: standing, Ivan Weirman; seated, Don Davern, Mrs. Weirman, and Mrs. Davern. Nearly 80 attended the event. Winner of a steak set was Earl Woods. —*Joseph W. Vincent*

Directory of ASTE Chapter Chairmen and Chapter Meeting Nights

AKRON, 3rd Tuesday, G. E. Holmes, 3723 Dell Dr., Barberton, O.

ALBUQUERQUE, 2nd Week, F. H. Deiber, 2842 Adams St., N.E., Albuquerque, N. M.

ANN ARBOR AREA, 3rd Wednesday, Dellmar Asplund, 1217 Birk Ave., Ann Arbor, Mich.

ATLANTA, 3rd Monday, Prof. J. L. Morris, Georgia Institute of Technology, Atlanta, Ga.

BALTIMORE, 1st Wednesday, R. W. Coleman, 3803 S. Hanover, Baltimore, Md.

BATTLE CREEK, 2nd Monday, C. F. B. Koons, The Oliver Corp., 423 E. Michigan Ave., Battle Creek, Mich.

BINGHAMTON, 1st Wednesday, D. O. Williams, 242 Hayts Rd., R.D. 3, Ithaca, N. Y.

BOSTON, 2nd Thursday, K. G. Nowak, Fenwal Inc., 32 Pleasant St., Ashland, Mass.

BUFFALO-NIAGARA, 2nd Thursday, C. S. Oliver, 69 Fruehauf, Snyder, N. Y.

CALUMET AREA, 3rd Wednesday, L. L. Thill, 7519 Woodmar, Hammond, Ind.

CANTON, 4th Thursday, V. Shelton, 1428 31st St., N.E., Canton, O.

CEDAR RAPIDS, 3rd Wednesday, C. F. Bryant, 916 H. Ave., N.W., Cedar Rapids, Ia.

CENTRAL PENNSYLVANIA, 1st Wednesday, R. E. Livingstone, 1717 Stanton St., York, Pa.

CHAUTAUQUA - WARREN, 3rd Thursday, H. Cave, 163 Pearl St., Frewsburg, N. Y.

CHICAGO, 1st Monday, J. H. Beck, 5740 W. Chicago Ave., Chicago, Ill.

CINCINNATI, 2nd Tuesday, J. C. Maezer, Cleveland Automatic Mach. Co., 4932 Beech St., Cincinnati, O.

CLEVELAND, 2nd Friday, H. Hausrath, 17912 Olympia Road, Cleveland, O.

COLUMBUS, 2nd Wednesday, Prof. J. N. Edmondson, 212 Industrial Engineering Bldg., Ohio State University, Columbus, O.

DAYTON, 2nd Monday, R. Dusseau, Box 393, Centerville, O.

DECATUR, Last Thursday, Arsene Pretot, 887 W. Olive, Decatur, Ill.

DENVER, 2nd Thursday, W. Krieger, 4755 Bryant St., Denver, Colo.

DES MOINES, 3rd Wednesday, John Hug, 210 S. Russell St., Ames, Ia.

DETROIT, 2nd Thursday, S. C. Phillips, 16011 Amherst, Birmingham, Mich.

ELMIRA, 1st Monday, C. F. Roe, 105 Oakwood Ave., Elmira, N. Y.

ERIE, 1st Tuesday, W. F. Snook, 2651 Dobbins Rd., Erie, Pa.

EVANSVILLE, 2nd Monday, J. E. Race, 2501 Adams Ave., Evansville, Ind.

FAIRFIELD COUNTY, 1st Wednesday, P. R. Marsilius, Producto Mach. Co., 990 Housatonic, Bridgeport, Conn.

FOND DU LAC, 2nd Friday, J. Bahr, Wisconsin Engrg. Co., P.O. Box 199, Oshkosh, Wis.

FORT WAYNE, 2nd Wednesday, C. A. Haugk, 2134 Thompson, Fort Wayne, Ind.

FOX RIVER VALLEY, 1st Tuesday, D. E. Zierk, 501 E. Edwards, Dundee, Ill.

GOLDEN GATE, 3rd Wednesday, L. D. Roulund, General Grinding Co., 850 50th St., Oakland, Calif.

GRAND RIVER VALLEY, 1st Friday, P. L. Barber, 29 Crestwood Ave., Kitchener, Ont.

GRANITE STATE, 2nd Tuesday, R. N. Wiley, General Electric Co., Main St., Somersworth, N. H.

GREATER LANCASTER, 2nd Tuesday, Truman Coy, 311 E. Main St., New Holland, Pa.

GREATER NEW YORK, 1st Monday, H. W. Barclay, King St., Who Torok Farm, Port Chester, N. Y.

HAMILTON DISTRICT, 2nd Friday, J. M. Snyder, 43 Elm St., Brantford, Ont.

HARTFORD, 1st Friday, R. L. Gay, 843 Main St., Room 14, Manchester, Conn.

HENDRICK HUDSON, 3rd Wednesday, L. E. Morse, Ford Motor Co., Green Island, N. Y.

HOUSTON, 2nd Tuesday, H. Boswell, 2317 Persa, Houston, Tex.

INDIANAPOLIS, 1st Thursday, J. P. Enright, R.R. 6, Box 479C, Indianapolis, Ind.

JACKSON, 3rd Monday, F. L. Foote, 3402 Pine Ridge, Jackson, Mich.

KALAMAZOO, 4th Tuesday, C. A. Elzinga, Industrial Sales & Engrg. Co., 3301 Portage St., Kalamazoo, Mich.

KANSAS CITY, 1st Wednesday, H. W. Buddenbohm, 6320 W. 81st St., Overland Park, Kan.

KEYSTONE, 1st Thursday, H. S. Von Goldberg, 102 William St., Pittston, Pa.

KNOXVILLE - OAKRIDGE, 1st Tuesday, C. C. Lasater, 2557 Magnolia Ave., Knoxville, Tenn.

LaCROSSE, 4th Tuesday, W. Bertelson, 2015 S. 30th St., LaCrosse, Wis.

LANSING, 4th Monday, R. F. Gietzel, R.R. 2, Box 380, Lansing, Mich.

LEHIGH VALLEY, 3rd Friday, W. O. Miller, R.D. 1, Box 327, Blue Marsh, Sinking Springs, Pa.

LIMA, 3rd Thursday, R. E. Fromson, 340 S. Kenilworth, Lima, O.

LITTLE RHODY, 1st Thursday, W. T. Nystrom, 274 Smithfield Ave., Pawtucket, R. I.

LONDON-ST. THOMAS, 3rd Thursday, F. W. Lewis, 43 John St., St. Thomas, Ont.

LONG BEACH, 2nd Wednesday, C. B. Edson, 425 E. 238th Place, Wilmington, Calif.

LONG ISLAND, 2nd Monday, G. C. Bennett, 28-34 36th St., Long Island, N. Y.

LOS ALAMOS, 2nd Wednesday, H. J. Von Steeg, 2183-B 36th St., Los Alamos, N. M.

LOS ANGELES, 2nd Thursday, J. E. Riddle, Tools Inc., 5428 W. 104th St., Los Angeles, Calif.

LOUIS JOLIET, 3rd Tuesday, M. Burdett, 1522 Dearborn, Joliet, Ill.

LOUISVILLE, 2nd Tuesday, G. H. Wilhelm, Wilhelm Tool Agency, 1551 Bardstown Rd., Louisville, Ky.

MADISON, 3rd Thursday, J. T. Murray, Gisholt Mach. Co., 1245 E. Washington Ave., Madison, Wis.

MEMPHIS, 2nd Friday, W. C. Roth, Western Textile Products Co., 594 Linden, Memphis, Tenn.

MERRIMACK VALLEY, 1st Thursday, R. I. Robbins, 55 Red Spring Rd., Andover, Mass.

MID-HUDSON, 2nd Tuesday, H. J. Tesmer, West View Dr., Cochran Hill, Poughkeepsie, N. Y.

MILWAUKEE, 2nd Thursday, R. E. Bodendoerfer, 5353 N. 54th St., Milwaukee, Wis.

MOHAWK VALLEY, 4th Tuesday, E. A. English, P.O. Box 201, Utica, N. Y.

MONTREAL, 3rd Wednesday, T. C. Hill, 1120 Beauclerk St., Longue Pt., Montreal, Que.

MUNCIE, 1st Tuesday, C. A. Darger, C. A. Darger & Associates, Box 670, Muncie, Ind.

MUSKEGON, 2nd Tuesday, J. E. Swineheart, Clark Sanding Machine Co., 30 E. Clay Ave., Muskegon, Mich.

NASHVILLE, 3rd Tuesday, A. Dobert, Circle Dr., Manchester, Tenn.

NEBRASKA, 3rd Thursday, S. L. Grasso, Inland Automatic, 1108 Jackson, Omaha, Neb.

NEW HAVEN, 2nd Thursday, J. S. Brozek, Wellington Dr., Orange, Conn.

NEW ORLEANS, 2nd Tuesday, J. P. Cimo, 1132 N. Dupre, New Orleans, La.

NIAGARA DISTRICT, 1st Thursday, C. R. Mitchell, 27 Oakridge, St. Catharines, Ont.

NORTH TEXAS, 2nd Friday, J. E. Franklin, 705 N.W. 9th St., Grand Prairie, Tex.

NORTHERN MASSACHUSETTS, 3rd Tuesday, J. R. Moore, Union Twist Drill Co., Chestnut Hill Ave., Athol, Mass.

NORTHERN NEW JERSEY, 2nd Tuesday, H. W. Ryno, 1060 Broad St., Newark, N. J.

PATERSON, 2nd Monday, C. Corsini, 99 Kentucky, Paterson, N. J.

PEORIA, 1st Tuesday, V. W. Schelischmidt, 1200 Dechman, Peoria, Ill.

PETERBORO, 1st Thursday, A. L. Jeffries, 480 George St., S., Peterboro, Ont.

PHILADELPHIA, 3rd Thursday, E. Hollingsworth, Tools Inc., 86 Bethlehem Pike, Philadelphia, Pa.

PHOENIX, 1st Monday P. D. Colburn, Reynolds Metals Co., P.O. Box 2289, Phoenix, Ariz.

PIEDMONT, 2nd Monday, S. B. Jeffreys, Jeffreys Engr. & Equipment Co., Guilford Bldg., Greensboro, N. C.

PITTSBURGH, 1st Friday, E. W. Weissert, S. P. Tracy Co., 919 Fulton, Carnegie, Pa.

PONTIAC, 3rd Monday, D. C. Inman, 33 Utica Rd., Pontiac, Mich.

PORTLAND, ME., 2nd Friday, H. H. Chaplin, Loren Dyer Co., 320 Commercial St., Portland, Me.

PORTLAND, ORE., 3rd Tuesday, F. D. Mondin, 8504 S.W. White Pine Lane, Portland, Ore.

POTOMAC, 1st Thursday, L. P. Schade, 174 Chesapeake St., S.W., Washington, D.C.

RACINE, 1st Monday, M. E. J. Otto, 1609 Packard Ave., Racine, Wis.

RICHMOND, 2nd Tuesday, C. H. Bowman, 19 S.W. 5th St., Richmond, Ind.

ROCHESTER, 1st Monday, G. K. Sick, 100 Lehigh, Rochester, N. Y.

ROCKFORD, 2nd Thursday, R. H. Spengler, 1226 Garrison, Rockford, Ill.

SAGINAW VALLEY, 3rd Thursday, A. W. Blackmon, Mach. Design & Engr., 643 Harrison, Flint, Mich.

ST. LOUIS, 1st Thursday, I. J. Schumaier, 435 Hampshire Ct., Webster Groves, Mo.

SALT LAKE CITY, 2nd Friday, H. J. Todd, 4165 Holloway Dr., Salt Lake City, Utah.

SAN DIEGO, 2nd Tuesday, H. C. Emerson, 600 Second St., Chula Vista, Calif.

SAN FERNANDO VALLEY, 1st Wednesday, H. T. Young, 14143 Runnymede, Van Nuys, Calif.

SAN GABRIEL VALLEY, 1st Thursday, I. S. Greensides, 1526 Delford, Duarte, Calif.

SANTA ANA VALLEY, Paul Jones, Jr., 708 S. Ohio, Anaheim, Calif.

SANTA CLARA VALLEY, 3rd Tuesday, J. T. McCarthy, 388 Burgoyne, Mountain View, Calif.

SCHENECTADY, 2nd Thursday, J. A. Sheridan, 9 Princeton St., Schenectady, N. Y.

SEATTLE, 4th Tuesday, A. R. Jones, 13857 1st Ave., S.W., Seattle, Wash.

SOUTH BEND, 3rd Tuesday, H. I. Housewerth, 521 S. 32nd St., South Bend, Ind.

SOUTHEASTERN MASSACHUSETTS, 3rd Tuesday, J. H. Somers, South St., Marion, Mass.

SPRINGFIELD, ILL., 1st Tuesday, L. L. Rasch, R.R. 3, Lake Springfield, Springfield, Ill.

SPRINGFIELD, MASS., 2nd Monday, P. F. Scott, 213 Bowles Park Ext., Springfield, Mass.

SPRINGFIELD, OHIO, 2nd Tuesday, P. R. Recknagel, Recknagel Mach. Prod., Shuey Bldg., Springfield, O.

SYRACUSE, 2nd Tuesday, E. B. C. Bloom, 1429 W. Onondaga St., Syracuse, N. Y.

TOLEDO, 2nd & 4th Wednesday, R. B. Sullivan, 5817 Garden Park Dr., Sylvania, O.

TORONTO, 1st Wednesday, C. P. Farr, 196 S. Kingsway, Toronto, Ont.

TRI-CITIES, 2nd Wednesday, R. E. Cannon, 2003 5th St., Moline, Ill.

TUCSON, 2nd Tuesday, S. S. Jacobson, 5601 Julius Stravenue, Tucson, Ariz.

TULSA, 2nd Thursday, R. R. Renouf, 15 S. Louisville Place, Tulsa, Okla.

TWIN CITIES, 1st Wednesday, J. W. Schwartz, R.R. 1, St. Paul, Minn.

TWIN STATES, 2nd Wednesday, M. H. Parker, 109 Merrill St., Springfield, Vt.

WESTERN MICHIGAN, 2nd Monday, C. V. Bonczyk, 921 Capen St., N.E., Grand Rapids, Mich.

WESTERN RESERVE, D. V. Zilliox, 207 Atlantic St., N.W., Warren, O.

WICHITA, 2nd Wednesday, R. O. White, 2319 E. 20th St., Wichita, Kan.

WILLIAMSPORT, 2nd Monday, J. B. Gehret, 2824 Euclid Ave., Williamsport, Pa.

WINDSOR, 2nd Monday, F. Ritchie, 60 St. Louis Ave., Riverside, Ont.

WORCESTER, 1st Tuesday, A. T. Kosciusko, 99 Bryn Mawr Ave., Auburn, Mass.

PROGRESS in production

METAL PRODUCTION BY REMOTE CONTROL

Titanium ingots are now being produced by Mallory Sharon Titanium Corp. in its double melting equipment being operated by remote control. This system of operation was devised with cooperation of safety experts from industry, the AEC, the U.S. Bureau of Mines and other organizations to minimize personnel hazards and assure continuity of production. Concern over safety arises not from the character of the metal itself, which is neither combustible nor nazardous, but the high temperatures involved in melting which create cause for extra precautions.

New furnaces have been constructed to withstand much higher pressures than those normally encountered, and are designed to vent outside the buildings. Operating technicians work from remote control panels out of sight of the furnaces, and behind concrete walls.

ASM READIES CONVENTION EVENTS FOR NOVEMBER EXPOSITION

For the 36th time the American Society for Metals will sponsor the National Metal Exposition and Congress. This year's show, which will be open November 1 through 5, will be housed in the International Amphitheatre in Chicago, Ill. Other organizations cooperating with ASM in the show are the American Welding Society, the Institute of Metals division of the American Institute of Mining and Metallurgical Engineers and the Society for Non-Destructive Testing.

Five halls will be open for exhibitors to display their equipment. Both the first and second floors of the Amphitheatre contain north and south wings while a fifth hall, comprising more than 29,000 sq ft of floor space in itself is located in the arena.

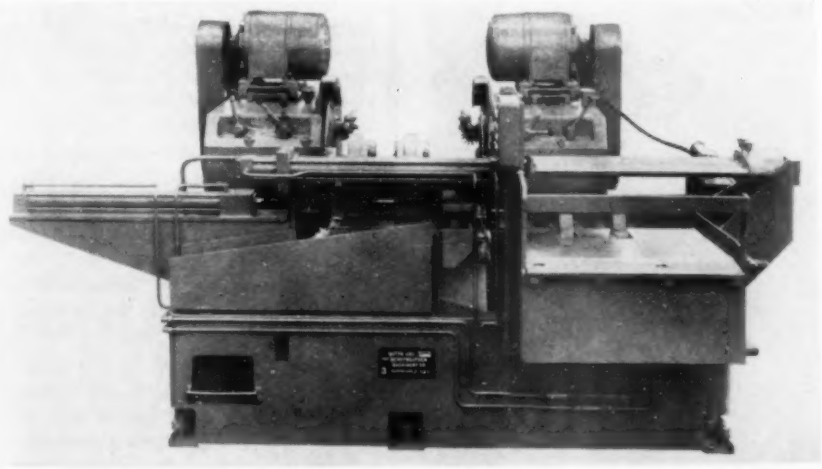
Coincidentally with the show, an extensive lecture program is being held with a number of important papers on themes pertinent to metals to be presented by authorities in the field.

Still another facet of the exposition will be the display of the numerous micrographs which have been entered in competition for awards and will be arranged as a Metallograph Exhibit.

W. H. Eisenman is again managing director of the exposition, with Chester L. Wells acting as assistant director.

Also being held in conjunction with the Metal Exposition and Congress are three half-days of sessions on practical industrial heating under the sponsorship of Industrial Furnace Manufacturers. The sessions, developed jointly by the ASM and IFMA, will cover theory and furnace applications of atmospheres, and induction and dielectric heating.

Running concurrently with the five-day show is the annual fall meeting of the American Welding Society which will cooperate with ASM on welding and cutting exhibits and demonstrations.



TWIN SAWING AUTOMATICALLY

Two sawing heads, at right and left hand, provide simultaneous cropping of both ends of an 8-inch shell forging on this Duplex Cropping sawing machine designed and built by The Motch & Merryweather Machinery Co. The sawing heads have nine spindle speeds, multiple disc clutch for engaging the spindle drive and self-contained lubrication system to all bearing points. Operation is automatic from the time the hydraulically actuated loading ram pushes the shell into the clamping station, through the clamping into position, sawing off of excess material, release and transfer of the shell into a discharge chute by the hydraulically operated unloader.

AUTOMATION WITH A THREE-JOB MACHINE

A drill unit, a broaching machine, and a stamping unit have been combined into an automated 3-station machine at Colonial Broach Co. in Detroit. All individual operations are performed on a single common base in one continuous cycle.

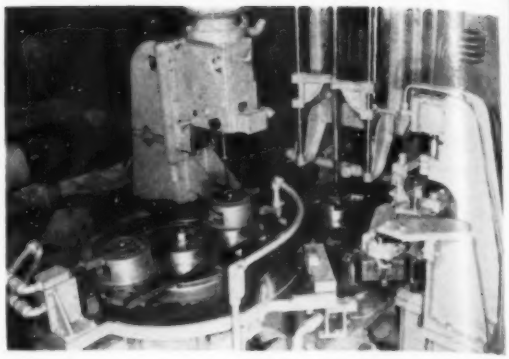
Loading and indexing mechanisms form the heart of the automated machine, around which the three individual machining operations are grouped. Typical machining cycle on an automotive camshaft sprocket includes these operations in the following order:

(1) Drilling one 0.2656 in. diameter hole in the web of the sprocket
(2) Broaching a 0.1885-0.1905 in. keyway in the shaft hole
(3) Stamping the timing mark on the sprocket.

Locating guides in the loading indexing fixtures maintain three operations

in proper relationship to one another. Broaching is accomplished by a Colonial RD-624, pull-down broaching machine. A special hydraulically actuated unloader deposits the completed parts onto a conveyor.

Key to this unit is the table loading and indexing mechanism. The indexing table is located off-center and below the loading table. Parts are loaded 6 at a time into circular holders on the ends of oscillating loading arm to be dropped, one at a time onto the indexing table. When the sixth piece drops, it triggers a switch that swings the arm around to a position where the empty holder is reloaded and the holder on the opposite end begins discharging parts into the chucks on the index table.

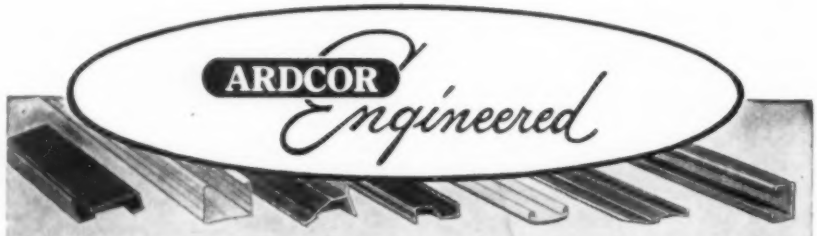


Parts machines in this three-station machine are manually loaded onto holders on each end of a loading arm; are then deposited into special chucks on the indexing table. The table indexes every 45 degrees as parts are drilled, broached, stamped.

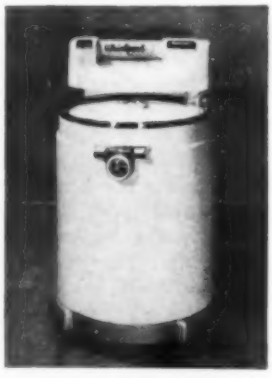
The rotating index table is hydraulically actuated. Four special chucks, equally spaced around the periphery, receive and locate parts from the loading mechanism. The table is indexed between adjacent chucks or every 45 degrees, allowing the broaching tool to be returned following its working stroke.

The machine performs the three machining operations (in example illustrated, work is on sprockets) plus loading and unloading, on over 200 parts per hour.

ARDCOR *Engineered*

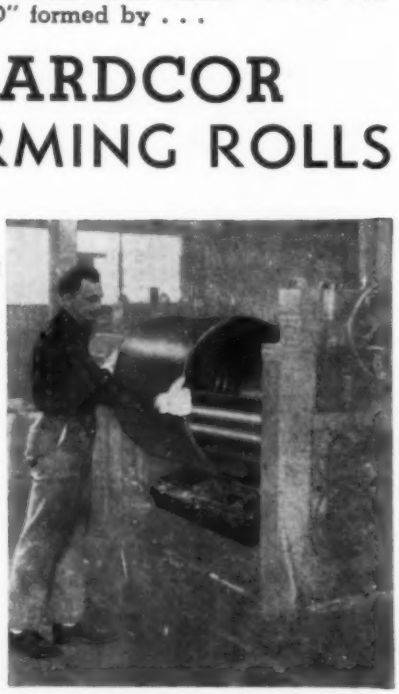


MEANS BETTER COLD-ROLL FORMING



The outside shell of the WHIRLPOOL Surgamatic WASHING MACHINE—once composed of two half shells—is now a ONE-PIECE SHELL "WITH TOP BAND" formed by . . .

ARDCOR FORMING ROLLS



Perhaps your roll forming can be equally improved through the assistance of Ardcor Roll Forming Engineers!

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-108

NEW DESIGN SIMPLIFIES SMALL PARTS PLATING

Problems arising from necessity of plating small parts of types which must be kept separated are common to the office machine makers. Each batch for plating is small yet must be done on a large production scale.

One company had been using an oval, perforated, plastisol-covered steel container about five inches in diameter for their work. Made in two halves, this shell fitted together with a threaded center bolt. One half was filled with parts for plating; then the two halves could be fastened by turning one into the other. About three inches of chain attached to each end of the container picked up the cathodic current. The loaded container was put into a standard barrel plater and tumbled with other work. Handicap to this procedure was that small part work was dependent on other plating work being done. Besides, the parts containers were so bulky that production was limited; hit and miss contact which was unavoidable under this method led to poor results; the containers were cumbersome and time consuming to handle.

Engineers of Udylite Corp. offered a solution to the problem by designing a

Producers Pare Stamping Costs

Modern Coil Handling Equipment Widens Use of Low Cost Coil Stock

The battle to keep down costs is going well for producers of stampings. Coil stock and modern coil handling equipment are the decisive factors. Coil stock, with only two scrap ends to its entire length is far more economical than strips of straight stock with two scrap ends to every ten feet. Moreover, the type of coil loading and handling equipment built by F. J. Littell Machine Co. makes coil stock easier to handle than straight stock. Stamping producers are taking full advantage of these developments. Coil stock and Littell Coil Hooks, Reels, Straightening Machines and Automatic Roll Feeds are in wider use today than ever before.

Hooks Serve Two Ways

. . . Littell Hooks make it a simple matter to unload coils on delivery, and to load reels. The variety of sizes have lifting capacities from 1,000 to 40,000 pounds.

Two Types of Reels . . .

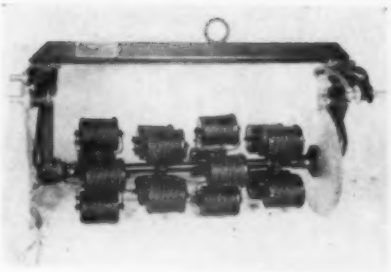
Littell Coil Cradle Reels mount heavy coils, up to 30,000 pounds. Spindle Reels handle coils up to 40,000 pounds. Each type is available in plain or motor driven designs.

Straighteners Flatten Stock... Removing curvature from coil stock as it passes from reel to punch press die is the function of Littell Straightening Machines. All models are the same basic design. Variation is in the number and diameter of straightening rollers employed . . . from 1" to 90" in width, and from .010" to .125" thickness.

Automatic Roll Feeds . . . Press output in many shops has been multiplied five times by simply attaching Littell Roll Feeds to presses for blanking, drawing, piercing, or cut-off work. The Littell Roll Feed is used with compound dies, single station dies, and progressive dies. Standard models are easily attached, serve all types of presses, and handle all standard widths and thicknesses of stock.

Descriptive details and prices on Littell Hooks, Reels, Straighteners and Roll Feeds are available on request. Inquiries are given immediate attention when addressed to

F. J. Littell Machine Co.
4199 N. RAVENSWOOD AVE.
CHICAGO 13, ILL.
INDICATE A-10-109-1



set of miniature tumbling barrels on a rotary rack. Proper constant current is conducted to each container.

A large gear ring rotates the shaft on which the small containers are mounted. Each container, which is a complete unit in itself, can be easily snapped out of the set arrangement for ease of loading and unloading. The cluster barrel, with its bail type superstructure can be used in a standard plating barrel.

TOOLING CHANGES SPEEDS OPERATION

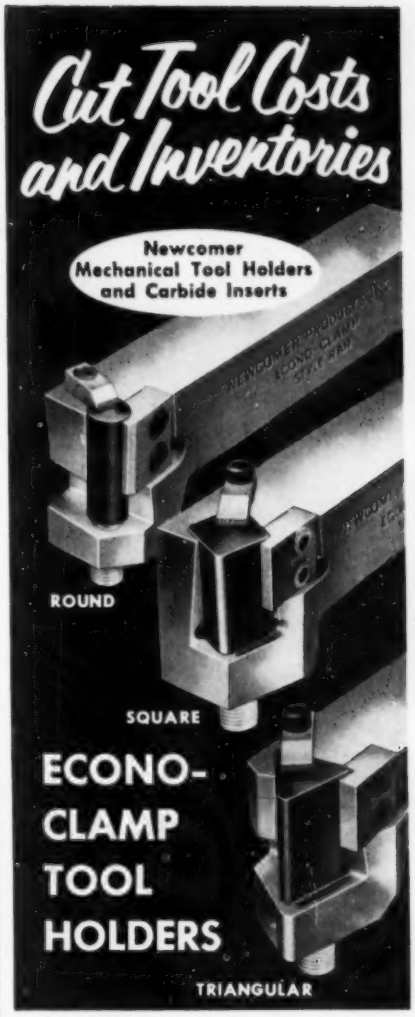
Innovations introduced at the Ambridge, Pa. plant of The National Supply Co.'s Spang-Chalfant Div. have speeded up operations and simplified tooling, maintenace and work handling.

The plant produces seamless double seal shrink thread drill pipe and extreme line casing. Many sizes of drill pipe and extreme line casing are machined in this department and because of the pipe size, the tools required are very heavy. Change in individual tools to begin a run of pipe of different diameter was hard and time consuming. Prime alteration then was a turn from use of individual tools to completely tooled turrets. With this tooling, when a run on a new diameter is beginning, one turret is simply replaced with another. Time required for change-over has consequently been cut from 12 to 16 hours to approximately 2 hours.

Use of multiple turrets proved a solution to still a second problem. Maintenance is simplified since turrets not in use are placed on convenient waist-high stands. This makes work easier and it can be accomplished without interruption to operation sequence.

The department setup utilizes standard Gisholt saddle-type turret lathes which have been specially adapted for their machining job. Each lathe is equipped with a fixed center, hexagon turret carriage from which all machining operations are performed. A six-jaw hydraulically operated chuck on the spindle nose, and a three-jaw hydraulically operated chuck on the rear of the spindle, drive and support the casing or drill pipe.

To get the work to the operators and



Newcomer Econo-Clamp Tool Holders provide a short-cut to economical production . . . machine down-time for tool grinding is minimized because multiple cutting edges on inserts can be utilized! Positive dual clamping features provide easy, quick and accurate indexing.

Econo-Clamps use standard full-length inserts or the more economical, short Newcomer "Throway" Carbide Inserts together with a hardened steel base anvil.

Newcomer Ad-Clamp Tool Holders are also available for use with standard rectangular blanks or the more durable Newcomer Step-Tip Blanks.

Send today for Newcomer Catalog 109-54!

NP
CONTROLLED QUALITY CARBIDE

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Latrobe, Pa.
General Sales Office:
512 Franklin Ave., Pittsburgh 21, Pa.

INDICATE A-10-109-2

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You can depend on JKS Diamond Tools

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- Over 65 Years of Successful and Fair Dealing

Send for your copy of our Tool Catalog or perhaps you may wish to consult our engineering staff for assistance on *your* Diamond Tool problem.

J. K. SMIT & SONS, INC.
Murray Hill, N. J.

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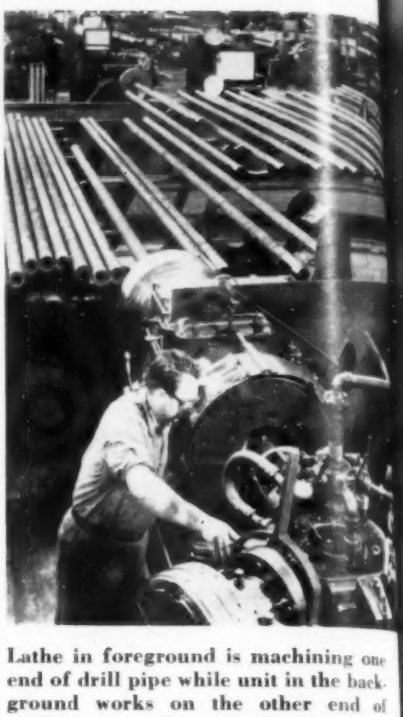


Lathe in foreground is machining one end of drill pipe while unit in the background works on the other end of similar pipe. Pipe handling rack in the center simplifies loading and unloading of machines. Replaceable hexagon turret which speeded production is clearly shown on lathe in foreground.

machines, special work handling equipment was also devised. Pipe and casing lengths range up to 40 feet, and must be finished at both ends. The lathes which do the work are located in two rows about 50 feet apart with headstocks facing. Machines on one side are tooled for finishing the male end of extreme line casing while machines on the opposite side finish the female end. When machining the thread drill pipe, machines on both sides are tooled to finish male ends.

Work handling equipment designed for the department consists of a special work handling table which carries the casing along until it reaches a lathe. At this point air-powered elevating rollers raise the casing to center height of the machine and convey it through the hollow spindle. After chucking, a pair of support rollers is raised and the elevating rollers drop out of the way. Thus, the lathe operator can load and unload his machine with little trouble.

To assure smooth functioning of the machine sequence, design of the work handling table permits casing to stockpile ahead of the lathes. Machines are staggered in spacing so that casing can also be stored between operations. With the aid to smooth functioning of machine sequence, about 40 pieces of completely machined extreme line casing are turned out per pair of machines on each 8-hour shift.

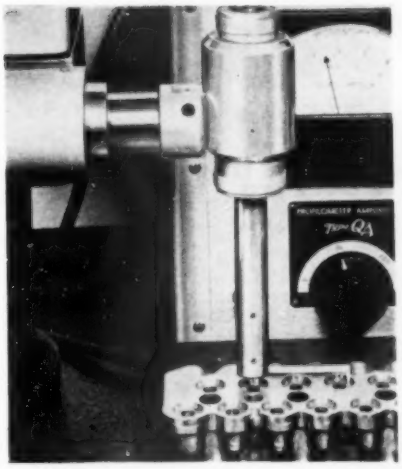
TOOLS of today

Measure for Roughness

Surface roughness across the bottom of flat-bottomed grooves and slots to 1/4-inch depth and behind shoulders to 1/4-inch height, can be measured with Profilometer Type GC tracer introduced by Micrometrical Mfg. Co. When measuring crosswise, the tool permits 1/16-inch length of trace in slots of 5/32-inch width, and greater length of trace in wider slots. It measures lengthwise in slots as narrow as 5/64 inch.

It also may be used in ID's from 25/64 inch to flat, and on all other internal and external surfaces where the geometry of the work permits and where the part can be mounted with the work surface approximately horizontal.

To permit reaching down into grooves and over shoulders, this unit has no skids, and the tracer point is at the bottom of a vertical extension at the end of a long beam. Construction requires that the tracer be supported and moved mechanically by a linear pilotor.



It can be used with any Profilometer Amplimeter.

Full details and specifications are given in Bulletin LT93, available from the company, 345 S. Main St., Ann Arbor, Mich. **T-10-1111**

Cutting Material

A carbide cutting material which contains no tungsten and no cobalt has been developed by Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa. The tungsten free material has a titanium carbide base in place of tungsten carbide, and nickel is used as a binder instead of cobalt while molybdenum carbide is used as an alloy carbide addition.

Characteristics of the tungsten free grades include high wear resistance and considerably reduced cratering action of steel chips. Tool life is considered excellent on steady finishing cuts, particularly when high speeds and fine feeds are employed in machining hard abrasive steels. **T-10-1112**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Scarf Mill

An open-side scarf and edge milling machine, the No. SM-100, primarily intended for use on nonferrous metals, has been announced by Ekstrom, Carlson & Co.

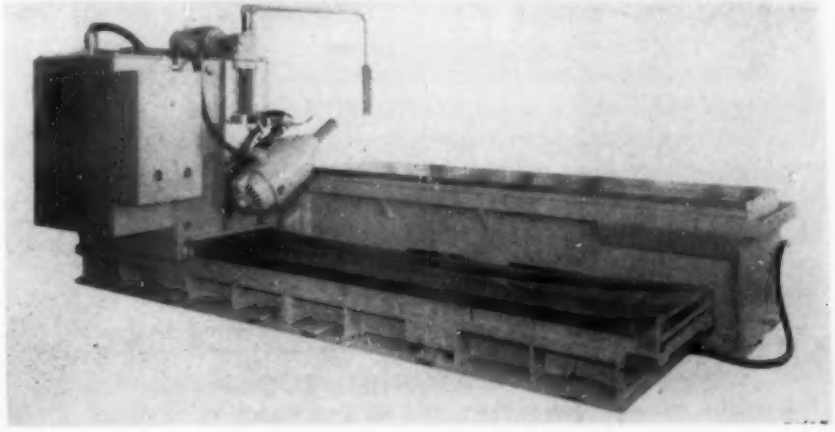
Mounted on a vertical column, the machine's horizontal spindle head can be adjusted to tilt a maximum of 30 deg either above or below the center line. This spindle head is driven by a 15/30 hp, 1800/3600-rpm motor and equipped with a No. 50 standard milling machine taper.

Its 36 x 144-inch worktable surface is furnished with three standard T-slots, and provides a 36-inch working height from floor to table top.

Travelling on one V and one flat way, the vertical column incorporates a variable feed rate ranging from 10 to 200 ipm plus jog-dynamic braking and rapid traverse. Both worktable and the herringbone pinion rack can be extended at one or both ends.

Pushbutton controls govern spindle head motor start and stop, rapid traverse of the column to either right or left and a variable feed rheostat.

Additional data is available from the company, 1400 Railroad Ave., Dept. M-17, Rockford, Ill. **T-10-1113**



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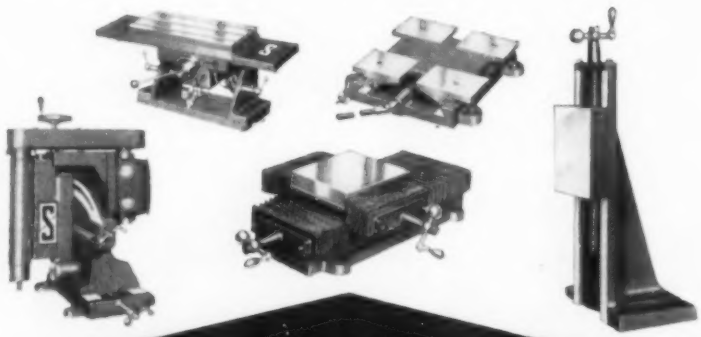

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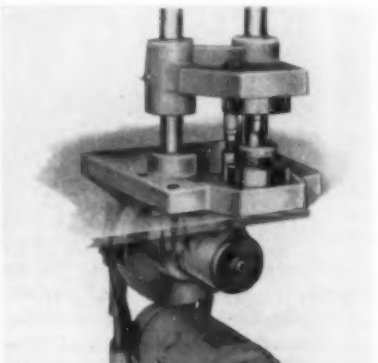
Precision Press Unit

This unusually designed precision power press, the Power-Di, has been placed on the market by Swanson Tool & Machine Products, Inc., Erie, Pa.

The 1-ton press substantially reduces tooling costs by eliminating need for die sets, since punches and dies of any shape may be mounted in retainers which are automatically aligned in opposing ram and bolster members.

A second feature of the Power-Di unit is its compact design, which makes it practical to set several of these units



in series for simultaneous piercing, notching or forming operations on large sheets which otherwise would require the use of much larger dies and punch presses.

Available as a bench or pedestal press or as an operational accessory for Swanson turret indexing units, the unit provides ease of operation with full access to the work area by the operator.

Units are complete and self contained, 1 ton capacity, 1¼-inch standard stroke, 3 to 6-inch shut height. 200 strokes per minute.

Bulletin PD from the company contains full details. **T-10-1121**

Band Saw for Metal

Development of a dual purpose metal-cutting band saw, the New 49A, is announced by Wells Mfg. Corp. It can be used either as a horizontal, or as an upright band saw. Its portability and versatility make it particularly suitable for the small shop, on-the-job work, or as a utility unit in large shops.

No tools are required to change from horizontal to vertical service. It is converted to an upright band saw, merely by swinging the cutting head into vertical position.

As a horizontal cutoff saw, the unit has a capacity of 3½ x 6 inches (rectangular) and 3½-inch diameter (rounds).

The blade (½ inch x 0.025 x 5 feet) is driven by a ¼ hp, 115-volt motor, controlled by a manual switch, with automatic shutoff at the end of each cut. It has a V-belt drive with selective speeds of 54, 100 and 190 fpm, and is equipped with positive screw-type vise.

Bed area of the New 49A, 6½ x 24 inches; height to top of bed, 24 inches; floor space, 16½ x 38 inches; net weight is approximately 110 pounds.

Full details may be obtained from the company, 600 Service Rd., Three Rivers, Mich. **T-10-1131**

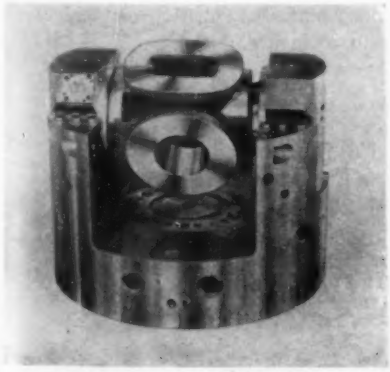
USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Indexing Chuck

Two-jaw power or scroll operated indexing chucks have been designed by the Cushman Chuck Co., Hartford, Conn., for holding workpieces having opposing and angular surfaces in specific relation to one another, to allow precision machining of all faces without having to unload and rechuck the workpiece.

The chuck body has two arms extending outward from the face and on which are mounted special master jaws. These are actuated by levers and move in and out in relation to the center of the chuck face plane. Centered on the master jaws are the revolving jaws which rotate at right angles to the master jaw action. Formed jaws, which actually hold the workpiece, are fastened to the revolving jaws, permitting the workpiece, though securely held, to be rotated between the master jaws. This enables the machine operator to revolve the workpiece from station to station for each machining operation.

Design and construction are such as to assure rigidity at all points of possible stress, while "bell-mouthing" of the master jaws is avoided, since point of contact between jaw operating levers and the master jaw is in line with the jaw ribs in the body. **T-10-1132**

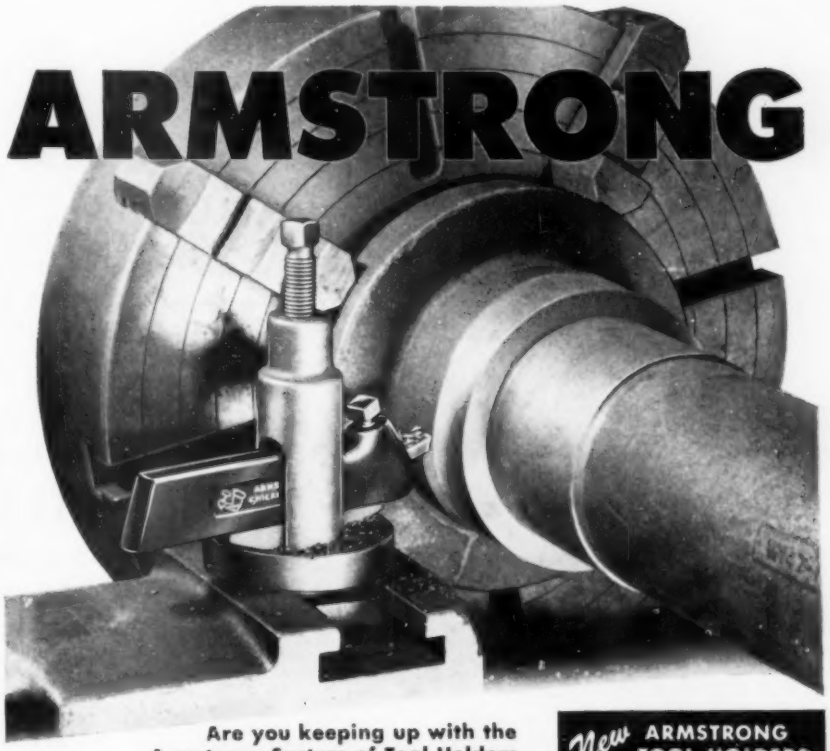


Micrometer

Fast measuring at top precision is possible with this micrometer caliper announced by The L. S. Starrett Co., Athol, Mass. It reads direct in ten-thousandths of an inch. Since it makes every measurement with exactly the right spindle pressure, there is no reliance on "feel."

This micrometer features the Starrett Hi-Precision thimble, consisting of an inner thimble reading in thousandths and an outer thimble with large, widely spaced graduations which give direct readings in ten-thousandths of an inch.

Using the micrometer conventionally, the measuring faces are brought up snug to the piece being measured, and then "loaded" by continuing to rotate the outer thimble through approxi-



Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

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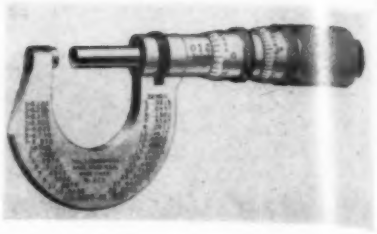


mately nine to ten divisions. The outer thimble is permitted to return under spring tension until the 0.001 graduation on the inner thimble lines up with the reading line on the sleeve.

The 0.0001 reading is taken directly from the outer sleeve. Accuracy throughout the range of the micrometer is within 0.00005 inch. Range is 0 to 1 inch. **T-10-1141**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Vise for Drill Press

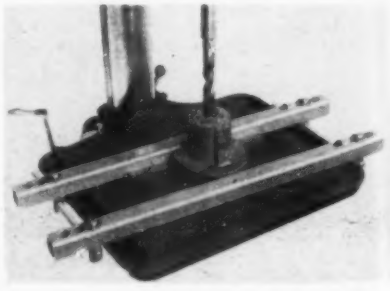
A drill press accessory which offers major time-saving and safety advantages is being distributed by Price & Rutzebeck, 22150 Meekland Ave., Hayward 153, Calif. This unusual work-holding vise, called the Dril-Lox, gives the simplest type presses the flexibility of a radial drill.

Design incorporates two main operating features: drill torque on the workpiece automatically locks the vise, as opposed to the conventional vise-locking-the-work principle; and workpieces in the vise find their own center since they are free-floating.

These features save time since necessity of clamping and aligning on every job is avoided. The Dril-Lox fastens quickly to the drill press table and no adjustment is required before drilling duplicate pieces. The vise can be slid off the table in an instant.

Irregular-shape castings can be held easily in the vise where work can be drilled, reamed, tapped or spot faced.

Four sizes are offered initially, with vise capacities ranging from 5¼ to 8¼ to accommodate drill press table from 8 to 23 inches. **T-10-1142**



High Temperature Switch

High - temperature applications particularly such as those in aircraft industries are the special field for the high precision switch announced by Micro Switch of Freeport, Ill., a division of Minneapolis-Honeywell Regulator Co.

Small in size, the switch, designated HHTI, has a capacity for switching a substantial electrical load in a temperature range of minus 50 deg to 1000 deg F.

Laboratory tests at 700 F show life in excess of 25,000 operations at a resistive load of 5 amperes 28 volts dc. At 1000 F the new switch has surpassed 9000 operations carrying a resistive load of 2 amperes 28 volts dc.

The switch is designed for panel mounting. Two thin hexagonal nuts and two lock nuts on the threaded bushing permit adjustment of the operating point without removing the switch from its mounting.

Characteristics include an operating force of 10 to 20 oz; pretravel of 0.065 in. max; differential travel of 0.010 in. max, and overtravel of 0.125 in. max.

T-10-1151

Portable Testing Lab

Metals, plastics, ceramics and quartz surfaces can be checked with a portable hardness testing lab weighing less than 15 pounds, designed by Peabody Industrial Co., 2832 E. Gd. Blvd., Detroit, Mich.

This testing kit includes two 7-oz instruments, one for testing steel in the hard range, incorporating both Rockwell C and Brinell 3000 kg equivalents. The nonferrous instrument has the Rockwell B and 500 kg Brinell scales. All hardness values are read directly with no conversions necessary.

Clear plastic tubing is used to keep dust and shop grime from entering close tolerance parts that might cause erratic and unreliable tests.

Minimum surface deformation is accomplished by the use of 50-gram weights.

No parts are too large to check with these instruments. A lightweight anvil is used for supporting small specimens and laboratory test blocks for exact calibration.

T-10-1152

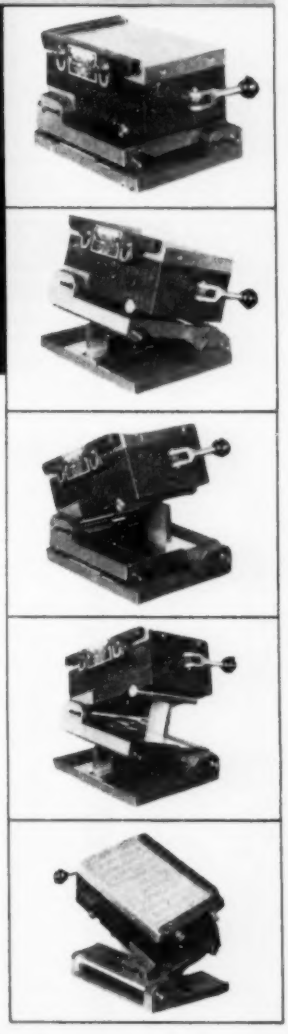
Lathe Tool

A tool developed by Schultz Mfg. Co. for production turret lathe work provides accurate and identical center drilling throughout a production run. Called the Identi-Center, it is a combination rotary stock stop and center drill holder. It occupies one hole in the hex turret of the lathe. Since the hardened cap of the tool rotates on a ball bearing when the stock meets it, there is no need to shut off the machine when measuring stock.

For center drilling, all that is neces-

Industry's most versatile Magnetic Chuck

MAGNA-SINE



Here is a magnetic chuck that not only handles your parallel work but angular work, too. And angular set-ups to gauge block accuracy take but a matter of minutes!

Any angle—single or compound—is set up by inserting gauge blocks between the Magna-Sine's precision hinged base plates. Correct blocks to use are indicated in Table of Constants provided. Hours of set-up time are saved, angular accuracy is positive, work is held distortion-free on permanent magnet chuck.

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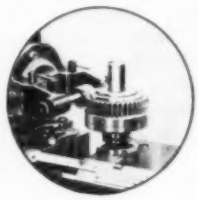
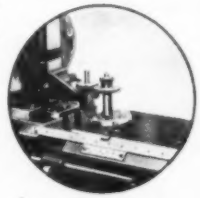
PARKSON GEAR TESTERS

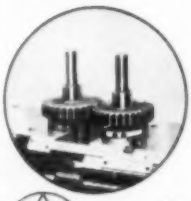
The Rolling Test is Practical Common Sense

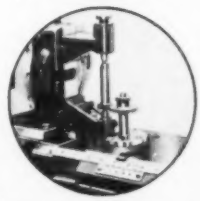
- Indicates RUN-OUT, CENTER DISTANCE by 1/1000 vernier, BACKLASH, TOOTH JUMP, etc.
- It catches the error directly in the shop where the gears are cut.

The MODEL B shown takes in SPUR WORM SPIRAL and BEVEL GEARS from 1/4" to 9" Center Distance









STUDY THESE PICTURES and reflect how ingeniously and simple every gear problem has been solved, including pinions with shaft, small gear 1/2" center distance, worm gears, spiral gears and even bevel gears. All without extra attachments.

NOTE that in the PARKSON the tests are being made on fixed arbors or studs avoiding rotating shafts or bearings liable to introduce errors not in the gears themselves.

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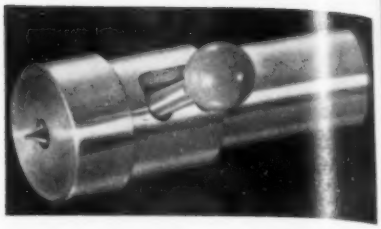


sary is to back up the turret about an inch and shift a lever which brings the center drill into position. It is then fed in until the rotary cap revolves again and the operation is complete. It is even possible to mike the diameter of the drill at the face of the stock stop.

The center drill can be easily removed without taking the tool from the turret. Depth of the center drill cut can be adjusted easily with a screwdriver.

Shank diameters available are 1, 1¼, 1½ and 1¾ inches. Additional information is available from the company, 3444 Orange Ave., Dept. N-18, Cleveland 15, O. **T-10-1161**

Tap-Drill Attachment

Errington Mechanical Laboratory, Inc., Staten Island 4, N. Y., announces the Errington tap-drill attachment. This is a combination attachment to drill, countersink, ream, counterbore and tap, all on the one drill press spindle without requiring the operator to take his hand off drill press feed handle. Work

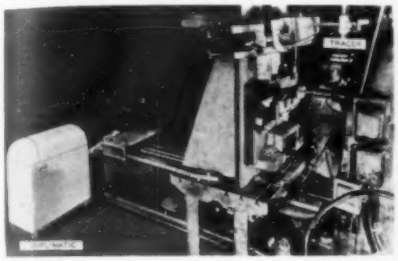
is simply slid under the head from one spindle to another. An automatic reversing tapping spindle is built into the attachment, making it unnecessary to replace the drill press for tapping.

Capacity of the tool is up to ¼-inch drill and 5/16-inch tap. The tap drill attachment is available with 2, 3 or 4 spindles. Spindles are spaced to handle work up to 5½-inch outside diameter. **T-10-1162**

Improved Tracer

Tracer Control Co. has purchased from Lodge & Shipley Co. the contour machining duplicator for which they have been national distributors. Now Tracer Control will manufacture the device and will sell it nationally through machinery dealers.

The unit, which has now been named Duplimatic, is electrically controlled and operated by hydraulic motors. It can be attached to most machine tools to control movements of the machine automatically. Simple operation permits semiskilled help to be employed to reproduce quality dies and produc-



tion parts from plaster models and metal templates.

Several improvements in design have been incorporated by Tracer Control to make the tool more flexible. Setup and dismounting are now possible in only a few minutes. When connected, the Duplimatic does not interfere with conventional use of a machine—pushing the stop button automatically disengages the duplicator and permits supplementary operations to be performed or another job to be run in without tearing down the setup; pushing the start button again engages the attachment.

Three models of the unit are available for controlling one, two or three feeds. All may be transferred easily from one machine to another.

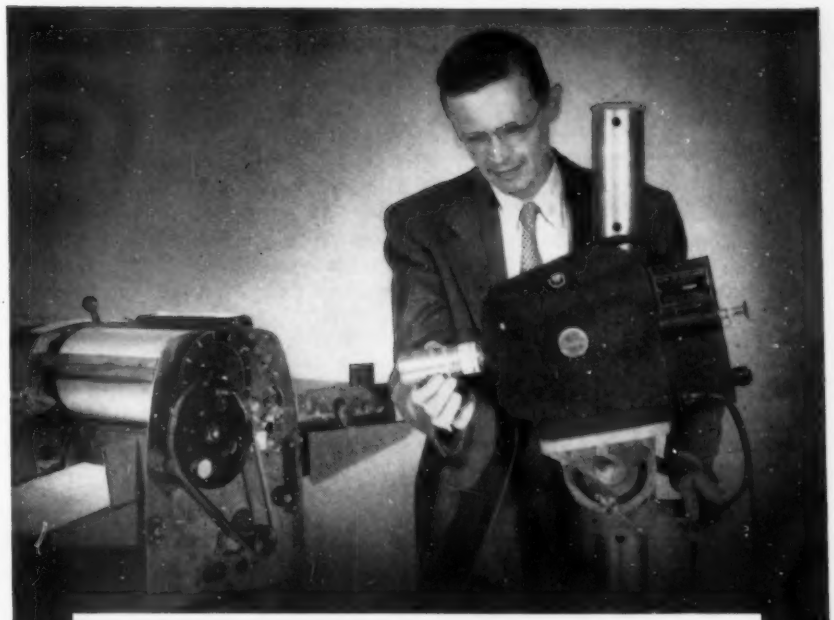
T-10-1171

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electrical Machine Positioner

An electrical device enabling the operator of a linear-motion machine to return the machine to a previous position within 1-percent accuracy has been developed by Control Products Co., Inc., 218 Noblestown Rd., Oakdale, Pa.

Called an Electric Position Transmitter for Linear Motion, the unit consists of a transmitter on the machine, a control panel at any convenient place, and an instrument located at the opera-



How this camera helped A·B·DICK meet a tight production schedule

It was like this: A. B. Dick Company was about ready to put their new Azograph duplicator on the market. But a centrifugal clutch was giving some trouble. Problem was not only to find what was wrong in a part moving too fast to see: whatever was done to correct the trouble had to be right the first time. The production schedule called for first deliveries in a few months.

So the company's Mechanical Research Laboratories used their Kodak High Speed Camera, which can take movies so fast that the action appears slowed down as much as 200 times when the film is projected at normal speed. They took movies of their unsatisfactory clutch in action, movies that showed gravitational forces at work, as well as the centrifugal ones, movies that suggested what to do. Then they changed the design and took more high speed movies. This time the movies showed that the clutch was right. And the movies convinced management that it was safe to go ahead with production.

All this was accomplished with a total of twelve 100-foot rolls of film. The Kodak High Speed Camera can do as much for many another plant that deals with fast-moving parts, processes, or fluids—has done so for manufacturers of products as diverse as beet harvesters, cigarette lighters, glass casseroles, breakfast cereals, and railroad locomotives.

Taking up to 3200 pictures a second on 16mm film, it has the right speed range for most industrial applications, requires no elaborate auxiliary equipment or engineering. You can find out more about how the Kodak High Speed Camera works and what types of problems others have solved with it by sending for your copy of "High Speed Motion Picture Making in Industry."

Industrial Photographic Division
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

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INDICATE A-10-118-1

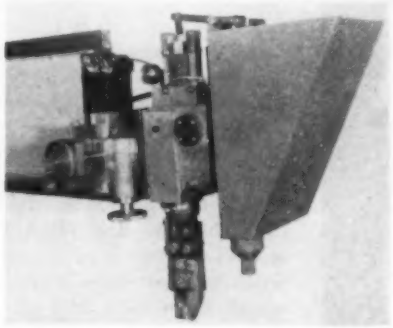
tor's control station. The positions of the machine are measured and transmitted exactly to the operator by the CPC unit.

One feature of the transmitter in this new CPC unit is that the rod which is tied to the machine has no mechanical stop, thus avoiding mechanical breakage from over-travel. The unit will transmit total travel in ranges from $\frac{5}{8}$ to 3 inches. **T-10-1181**

Welding Head Mount for Flexibility

Broadened versatility and productivity of automatic welding equipment are achieved by the Peck Uneek head mount introduced by Cecil C. Peck Co., 4614 Prospect Ave., Cleveland 3, Ohio.

The unit offers, in the single attachment, movement to accommodate all necessary and desirable adjustments for



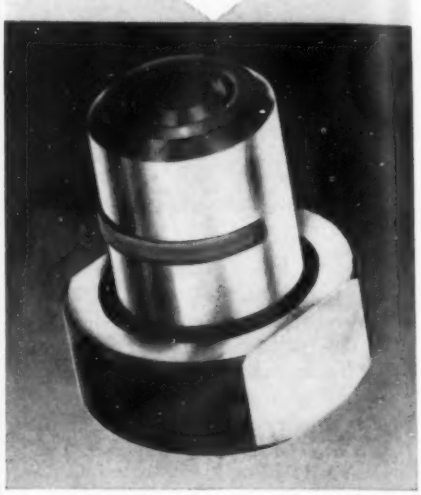
positioning welding heads. These include lateral movement for welding across a seam, left or right angular positioning; pointing or leading the filler wire ahead of normal downward position; movement so that filler wire has a backward inclination; stationary positioning at 90 deg to longitudinal travel to make circumferential welds.

The device is available for use with all standard welding heads and is easily mounted. **T-10-1182**

Automatic Carbon Controller

Surface Combustion Corp., Toledo 1, Ohio, has developed an Autocarb automatic continuous carbon controller for use in conjunction with its Dew Point recorder. The instrument, which provides for continuous control of the carbon potential of the furnace atmospheres, is used for control of furnace atmosphere in gas carburizing, clean hardening, and other heat-treating processes. **T-10-1183**

KEY UP for Competition with
SURE LOCK FIXTURE KEYS
and Save $9.92 on Every Milling Fixture



Eliminate Expensive Milled Keyways Entirely

SURE LOCK—the new, exclusive development in fixture keys, is meeting with wide success throughout the country. Some manufacturers are ordering them by the hundreds because...every fixture is immediately available to every machine regardless of T slot or size.

SURE LOCK KEYS are instantly interchangeable. Key can be locked from top or bottom as desired. When locked from the top automatic alignment is assured. Many other advantages. Write today for bulletin and prices. All sizes in stock.

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STANDARD PARTS CO.
1012 BROADWAY • BEDFORD OHIO
INDICATE A-10-118-2

Power Presses

Kenco Mfg. Co. has added two new models to its line of power presses; the 4 and 5-ton Rigid Rib presses, designed to give ultimate rigidity and strength for the weight of the press. Primarily, the units are designed to give deep throat punching with large die space area. The model 4R-four-ton has a 55-lb flywheel, roller bearing mounted. The Model 5R-five ton is a variable speed press with speeds from 90 to 285. It has a 130-lb, 18-inch diameter flywheel mounted on double roller bearing. Both presses have a positive single trip as standard equipment and can be converted quickly to continuous work by moving a single lever; 1 or 1¼-inch standard stroke is optional. Depth of

throat from center of the ram hole to the back is 12¾ inches. The shut height (1-inch stroke) is 8½ inches to the bolster plate, adjustment up, ram down. The bolster plate is 1 inch thick. Strokes up to three inches are available at extra cost. Tonnage is rated at 1 inch stroke. All parts are interchangeable and made extra heavy for long life and trouble-free operation.

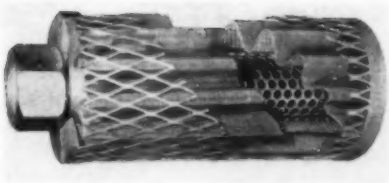
Detailed literature is available from the maker, 5211 Telegraph Rd., Los Angeles 22, Calif. **T-10-1191**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Filters for Nonflammables

Marvel Engineering Co. recently adapted all models of their sump and line type Synclinal filters for use in the filtration of all types of nonflammable hydraulic fluids.

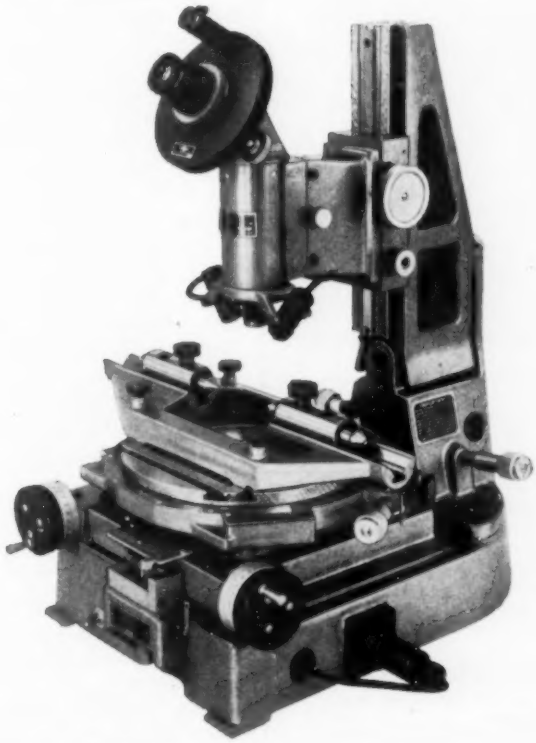
As in other models, basic design of the units provide balance between maximum filtering area and sufficient storage capacity for filtered out particles, to permit long periods of productive operation in the filtration of hydraulic oils, coolants and other oil base liquids in low pressure circulating systems.



The filters are available for either sump or line installation in capacities from 5 to 100 gpm. Multiple installation can make greater capacities attainable. Both sump and line types may be disassembled, cleaned and reassembled, by any workman, in a few minutes. Line type operates at full efficiency in any position and may be serviced without disturbing pipe connections. Complete data is available from the manufacturer, 625 W. Jackson Blvd., Chicago 6, Ill. **T-10-1192**

Gaertner OPTICAL INSTRUMENTATION

TO INSURE UNIFORM, ACCURATE PRODUCTION PARTS USE THE GAERTNER TOOLMAKERS' MICROSCOPE TO CHECK TOOLS, DIES AND GAGES



THE
GAERTNER TOOLMAKERS' MICROSCOPE
M2001ARS
2x4 inch Coordinate Measurement
Direct Reading to .0001 inches
Bulletin 147-50 tells the story in detail

THE GAERTNER SCIENTIFIC CORPORATION

1241 Wrightwood Avenue • Chicago 14, Illinois

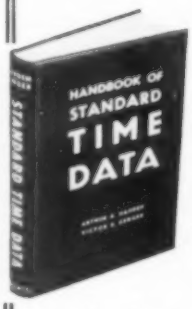
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-10-119

Boost Plant Efficiency . . .

Handbook of Standard Time Data

For Machine Shops

Arthur A. Hadden; *and* **Victor K. Genger,**
McClure, Hadden & Ortman, Inc.



THE FIRST one-volume source for all tested, detailed standard data needed for establishing machine shop time values. Up-to-date book provides separate tables for each common type of machine tool. Specifications recognize such variables as weight of piece, transportation, etc. Recommendations for machining and tables for machine elements based on type of equipment, amount of material to be removed, etc. *87 forms, 473 pages.* **$10**

PLANT LAYOUT AND MATERIALS HANDLING

James M. Apple, *Michigan State College*

COMPLETE, concise working manual shows how to develop the most efficient layout of equipment and operating facilities for greater production in manufacturing plants. Emphasizes the need for interconnected modern techniques as the only means of achieving a workable, money-making layout. All the essential information — from planning of operations and work flow to the final location of equipment. *198 illls., 367 pages.* **$5**

JOB EVALUATION METHODS

Charles Walter Lytle,
New York University

UP-TO-THE-MINUTE Second Edition offers a comprehensive survey of job evaluation. Each chapter is confined to a single functional step of the evaluation procedure, investigating and comparing various devices and techniques. Covers application of job evaluation to supervisory, technical, executive positions; contains expanded material on workable rate structure, merit rating, wage incentive methods, etc. *178 illls., 507 pages.* **$7.50**

——SEND BOOKS CHECKED——

- ☐ **Handbook of Standard Time Data,** *Hadden-Genger* **$10.00**
- ☐ **Plant Layout and Materials Handling,** *Apple* **5.00**
- ☐ **Job Evaluation Methods,** *Lytle* **7.50**

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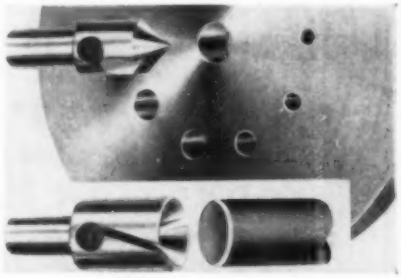
INDICATE A-10-120-1

Deburring Tools

Two companion tools, Nobursink and Noburod, for the fast, efficient and economical deburring and chamfering of both inside and outside diameters, have been added to the line of deburring tools manufactured by Nobur Mfg. Co., 717 N. Victory Blvd., Burbank, Calif.

The Nobursink is designed for openly accessible hole faces and the Noburod for the outer ends of rods, tubes and bosses. Low torque design permits rapid offhand workpiece handling without chatter or development of secondary burr, even on large diameters. Controlled cutter entry prevents snagging, seizing or excessive cutting. Both tools employ an unusual two-piece construction, permitting cone faces to be cylindrically ground on tool and cutter grinder or on any lathe with a tool-post grinder. Half members are then locked in a displaced position, to provide automatic radial relief.



Both tools will work well on all metals. Range of application extends from less than 1/16-inch hole size up to body diameter. Tools are furnished 90-deg included angle (produces a 45-deg chamfer), made from high-speed steel, carefully heat treated and precision ground. **T-10-1201**

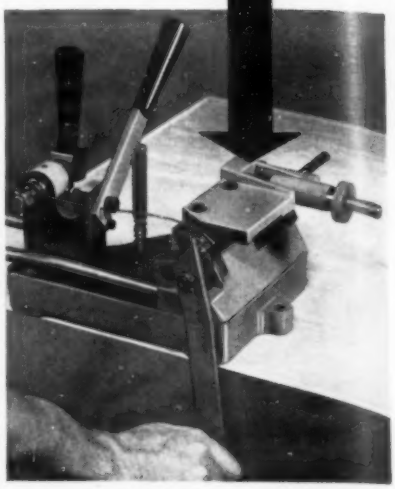
Electronic Micrometer

A combination of Brown & Sharpe standard precision tools forms an electronic micrometer which measures small parts to 0.00001 inch at magnification which is continuously variable from 1,800 to 18,000 times.

A standard electronic amplifier and gage head cartridge are combined with a standard indicating bench micrometer. A frictionless member supported by parallel reeds transmits motion from the anvil to the gage head cartridge, and the micrometer head is set to the required 0.0001 inch. When the tool is used for extremely fine measurements, its setting should be made to Johansson gage blocks or other precision gages.

Measuring pressure is adjustable

make Springs in Seconds!



Save Costly Special Orders With the NEW

DI-ACRO* Spring Winder

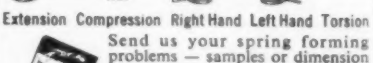
This unique machine eliminates costly special spring orders, saves valuable waiting time. Winds flat, torsion, compression and extension springs to 1½" O.D. Handles round, flat and rectangular wire to ⅛" dimension. Note exclusive features in the hand operated Di-Acro Spring Winder which assure accurate tension and fast operation without special experience or skill.

new **TENSION CONTROL**—Simply adjust to desired tension—the control keeps it uniform, for winding one spring or hundreds, and releases when each spring is wound.

new **WIRE CUT-OFF**—After spring is wound, release tension and use cut-off lever to quickly cut end of spring to desired length.

new **CAM LOCK**—Simply feed wire under cam, turn handle and wire is securely locked to arbor while spring is wound. No threading required.

FREE-SAMPLE SPRINGS



Extension Compression Right Hand Left Hand Torsion

Send us your spring forming problems — samples or dimension sketches—together with sufficient test material, and let us wind some sample springs for you free of charge. No obligation.

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BOOTH 1215
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O'NEIL-IRWIN MFG. CO.
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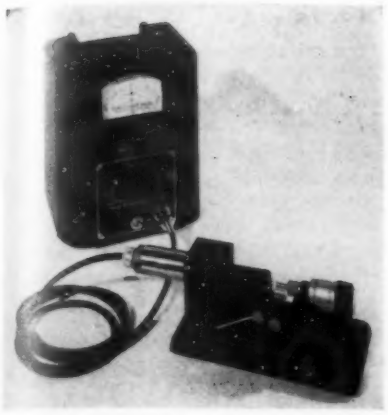
di-acro PRECISION METALWORKING MACHINES

INDICATE A-10-120-2



from 3 ounces to 2½ pounds, making it possible to use a measuring pressure suited to the requirements of the work being measured.

The tool is particularly adapted for measuring fine magnet wire, small screw machine parts, pivots, etc.

T-10-1211

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Milling Cutter

Close blade spacing combined with increased blade strength makes the use of unusually high feed rates possible with the inserted solid carbide blade milling cutter designed by Millit, Inc., 55 Flint St., Rochester 8, N. Y. Low replacement blade costs also contribute to the over-all picture of economical long-run metal removal using this cutter. Rectangular carbide blades are held in a tapered body slot by a round taper slotted wedge. The semi-standard carbide rectangles used for replacement blades can be obtained very economically from Millit, Inc. or direct from any carbide manufacturer.

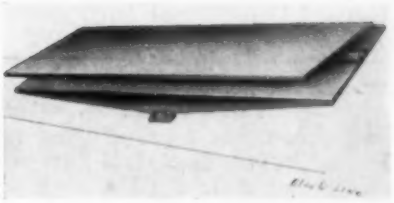
Blade strength is considerably increased by cutting on the narrow side of the rectangular carbide blade. This gives the cutting edge more solid carbide back-up. Body strength is increased by using a round body hole confined on all sides instead of the conventional open slot construction. Due to the compactness of the round wedge and rectangular blade, close blade spacing can be attained as can be seen by the 2-inch diameter cutter shown here with 8 teeth. These shell mills are available with two blade sizes 5/32 x ¼ x 1 and ¼ x ⅜ x 1½ and diameters range from 2 to 8 inches.

T-10-1212

Vacuum Chuck

O. S. Walker Co., Inc., Worcester, Mass., has a universal vacuum chuck which has been developed by John W. Odlin Co., Inc., Worcester 8, Mass., to increase the need of holding compound angles such as used in the aircraft industry.

Distribution of rapid vacuum gives immediate holding and avoids possibility of vacuum applied in one section. Vacuum is activated with limit switches to stop all machining before the vacuum diminishes to a dangerous point. A safety feature is provided in tell-tale lights denoting the approach of diminishing vacuum.



T-10-1213

RING PUNCHES DIES

MANY SHAPES and Types

- Round
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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-121

Liquid Dustproof Indicator

A wetproof indicator, in which the movement is fully protected against splashing coolants, oil, oil fog, or excessive dust, has been perfected by Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

One among several ways damaging liquids or dust can enter an ordinary indicator case is through the lower bushing. In the Federal wetproof indicator, a specially designed protective rubber boot fits tightly into special grooves in the stem and contact point. This boot allows free movement of the rack and at the same time effectively seals the opening.

Other places that oil or dust can enter a conventional gage are around the bezel, the dust cap and the back. On this indicator, a rubber sealing ring is placed between the bezel and the dial to seal it at this point. A lock ring, which can be loosened to set zero, holds the bezel securely in place. The back and dust cap are also sealed with rubber rings to make the case completely liquid and dustproof all the way around. **T-10-1231**

Double eccentric type for irregular spacing
Universal joint with slip spindle fixed locating plate
Single eccentric type for equally spaced holes on bolt circles
US HEADS

It's the wHOLE Truth.....

Machine tool men "in the know" have long acclaimed the "US" Adjustable Multiple Spindle Drill Heads with their quick-change universal joint assemblies. They are built for continuous use, with full anti-friction bearing construction for high capacity thrust loads. The universal joint adjustable multiple spindle type is suitable for any sensitive drilling machine. Joints are self-lubricating.

The single eccentric type is used for equally spaced holes on bolt circles.

The new double eccentric AdjUStafix, two to eight spindles, permits spindles to be located in non-symmetrical patterns. It eliminates expensive change in set-up.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

UNITED STATES DRILL HEAD CO., 616-618 Burns St., Cincinnati 4, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-122

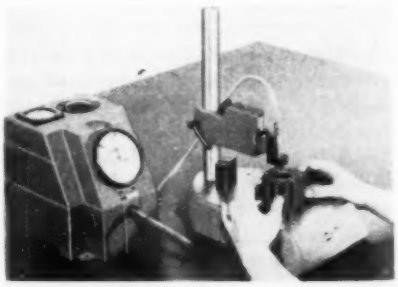
Freeze Treating Unit

Industrial coolers designed especially for the freeze treating of metals have been introduced by Conrad, Inc., Holland, Mich. Since in these chambers cooling of steel under treatment continues to temperatures of about —120 F,

relatively soft elements in the steel are transformed to hard strong constituents, giving a positive 'set' to the steel so that it does not change in structure over a period of time. This greater stability of the steel, and greater hardness, increases the life of tools, gages and dies, reducing costs and increasing efficiency. **T-10-1232**

Gage-Head for Air Gaging

A universal gage-head, the AirProbe, to use with its Dimensionair air gage, is now offered by Federal Products Corp., 1144 Eddy St., Providence 1, R. I. Since it can be mounted on a broad variety of fixtures, including regular catalog gages, the spindle-like AirProbe offers considerable versatility

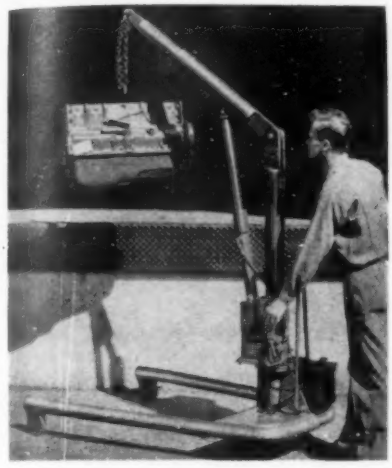


and makes it possible to check either single or multiple dimensions of almost any type.

Among the tool's main features are: accurate calibration which avoids requirement of tolerance setting masters; long range per magnification; identical shape and physical dimensions for all AirProbes. Excessive clamping pressure will not cause binding of the spindle. **T-10-1223**

Hydraulic Hoist

An electrically powered, hydraulic "utility" hoist made by Unit Mfg. Co., 1229 Harmon Place, Minneapolis, Minn., permits one man to lift up to 2000 lbs. in less than half a minute simply by pressing a button. In addition, this all-purpose hoist is quickly changeable from a mobile shop hoist to a truck bed or loading dock mounting, by lifting the hoist from the 4-



wheel floor truck to a well or socket mounted in any other position, and connecting the cables.

An hydraulic system rated at 5,000 psi, provides power to lift a 1,000-lb. load 8 feet with built-in boom extension; 1,500-lb. load 6½ feet; or 2,000-lb. load over 4 feet. The 6-volt motor is battery powered.

The manufacturer also announced that conversion kits for manually operated utility hoists now being used are available. **T-10-1231**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Air Control Devices

Perfecting Service Co. has announced a new line of PSC universal air control devices, consisting of air regulators, filters, lubricators, automatic drain traps, quick-coupling connectors, and Rotary air seals, which feature unusual principles of operation.

The PSC regulator employs a balanced piston principle with automatic bleed off, making possible sensitive adjustments to ¼ pound. Automatic compensation for volume increase or decrease permits multiple applications without resetting. Large, self-cleaning orifices reduce wear and maintenance.

The PSC air filter uses the cyclone principle to remove free water and oil

ALINA

KNURL CUTTERS

ALINA KNURL CUTTERS actually mill the pattern and produce chips in the process. Alina Knurl Cutters will cut your machining time approx. 30%. They will provide the solution to some of your most complex knurling problems.

DESIGNED TO

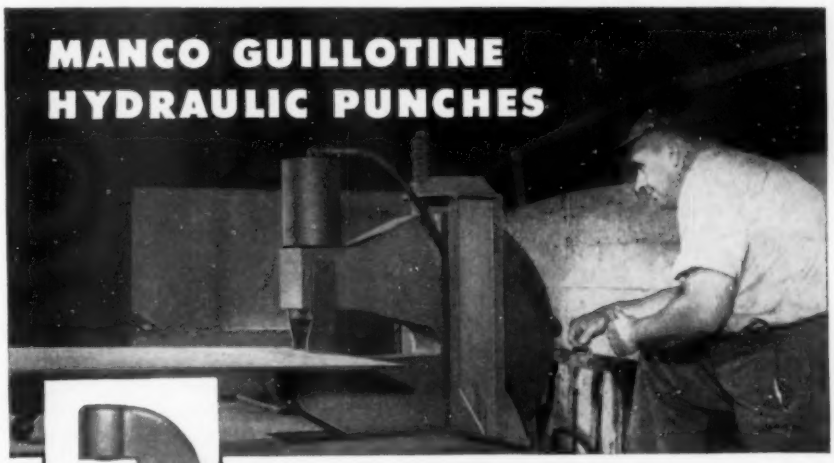
- knurl all machineable materials
- knurl thin-walled parts without internal support
- maintain fine diametral limits
- knurl diameters from 1/16" to 10 ft.

Models available for all types of machines.
For detailed information and prices, write to

ALINA CORPORATION • 401 Broadway, New York 13, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-123-1

MANCO GUILLOTINE HYDRAULIC PUNCHES



Model P-20-186
Capacity 1" hole in ⅜" mild steel. Reach 1⅝". Weight 44 lbs. Available with high-speed electric hydraulic or portable manual pump.

HIGH CAPACITY . . . STRUCTURAL OR FIELD WORK

There is a wide variety of fast, powerful Manco Guillotine Hydraulic punches with varying capacities, available for stationary production use, semi-portable boom-mounting, or complete portability for use in the field. Model P-75-E, above, equipped with Manco high-speed electric hydraulic pump offers 75 tons thrust and capacity for 1" hole in ¾" steel. Other models up to maximum capacity for punching 3¾" hole in 16-gauge sheet.

Write, stating requirements: hole size, location, quantity, accessibility, material punched

Dept. T-10

MANCO MFG. CO.

Bradley, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-123-2

from air lines. Uniform filtering through tight-woven wool filter element, filters out particles as small as 30 microns in size. Plastic cylinder permits visual inspection of filter.

The PSC air lubricator, which has a venturi action, supplies atomized oil to pneumatic equipment. The amount of oil injected into the air stream is directly proportionate to the flow and volume of air consumed. Balanced pressure principle prevents flooding.

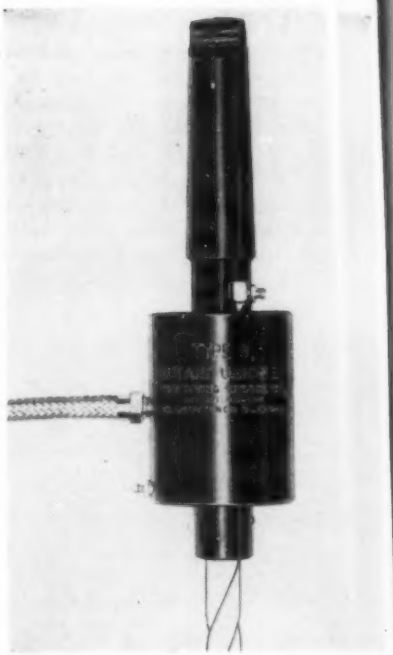
In addition, the company's line includes a combination air regulator, lubricator and filter in one compact assembly, simplifying installation, requiring only two connections.

Bulletin No. 75, explaining features of these and other air products is available from the company, 332 Atando Ave., Charlotte 6, N. C. **T-10-1241**

Deep-Hole Drilling Attachment

Perfecting Service Co., 332 Atando Ave., Charlotte 6, N. C., has designed a Rotary Union deep-hole drilling attachment so that oil and other industrial coolants may be fed from a stationary supply line through standard oil drills used in deep-hole drilling and thereby keep the drill sharp at the cutting edge. The pressure of the oil forces the chips out of the hole, making possible smooth drilled holes without scoring from chips. This oil feed attachment with its positive sealing mechanism and needle bearing construction permits pressures up to 1,000 psi and speeds up to 2,000 rpm.

This drilling attachment, Type D, is easily adapted to all types of drilling



and boring equipment. It is manufactured in two standard sizes with variations in adapter arrangements to handle standard drills and most drilling applications. Larger sizes and designs are available for individual and special applications.

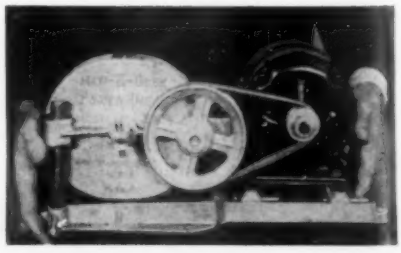
Bulletin No. 25 covers further information. **T-10-1242**

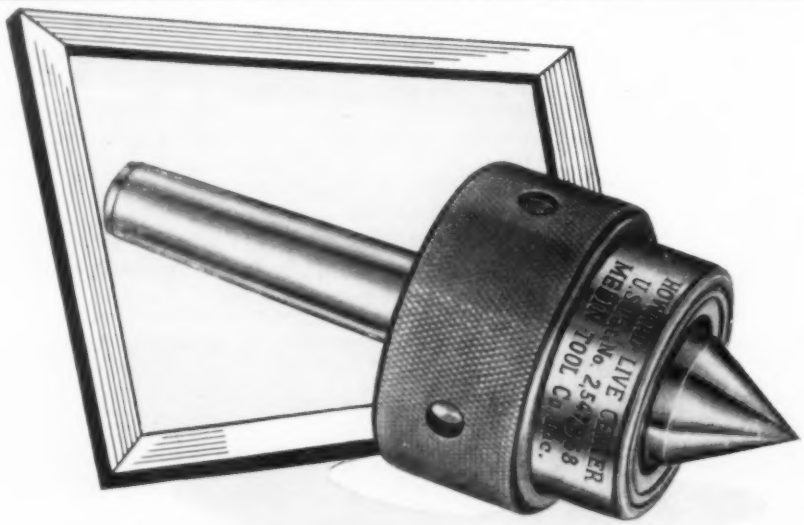
USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Low Cost Speed Reducers

The New Standard Div., U. S. Expansion Bolt Co., York, Pa. has developed a low cost speed reducing unit called Men-E-Uses featuring versatility from quick selections of variable speeds from 1 to 750 rpm. Available in two sizes, the new units meet power drive requirements of all ¼ to 2 hp motors.

The versatility of application and wide range of speeds obtainable from a single unit permits users to realize considerable savings by reducing investments in more expensive single-purpose equipment. **T-10-1243**





Finest **LIVE CENTER MADE**

. . . HERE'S WHY

★ **BACK UP RING** assures positive rigidity.

★ Bar Expansion Eliminated by means of Thrust Spring.

★ Special alloy tool steel spindles, hardened and ground.

★ Matched precision ball bearings, mounted in tandem.

★ Oil impregnated bronze tail bearing.

★ Points pre-loaded and ground after assembly.

★ A distinctive oil seal in front of bearings protects them from all foreign matter. Chips, dirt and cutting oil cannot reach the bearings.

The HOWARD Live Center is the *ONLY* center that offers the patented *BACK UP RING*. The Ring maintains solid contact between the quill and head of the center . . . thus greatly increases over-all rigidity.

Send for the new MELIN TOOL Catalog No. 54-C . . . it lists, in addition to specifications and prices on the HOWARD Live Center, the complete MELIN TOOL End Mill Line.

MELIN TOOL CO. INC.

MELIN TOOL COMPANY, INC.
3372 West 140th St.
Cleveland 11, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-124

Steel Press Brake

High-speed punching and automatic feeding applications can be accomplished with the high-speed Cincinnati all steel press brake, manufactured by The Cincinnati Shaper Co., Hopple, Garrard & Elam Sts., Cincinnati 25, Ohio. It operates at 70 strokes per

minute and is equipped with a specially arranged ram.

The machine has an all-steel rolled plate construction with an interlocked frame, push-button control to the ram adjustment, micrometer indicators on both ends of the machine, centerline loading, weld free joints and automatic pressure lubrication.

Additional features include the planing of a double hook tongue in the ram with the bed member doweled to the housings to withstand a twenty-ton stripping load. **T-10-1251**

Extra-Duty Gear Pump

Especially designed for difficult or heavy-duty service applications, this extra duty model of its tapered gear pump has been developed by The East Shore Machine Products Co., 50 East 201st St., Cleveland 23, Ohio, particularly to handle liquids containing materials of an abrasive nature or foreign matter.

The model V-3 pump is constructed to maintain its high initial mechanical and volumetric efficiency throughout its service life. By reason of its special taper design, any wear which occurs is automatically taken up without effect on clearances.

Indicative of the high efficiency of the unit is the 29-inch vacuum level it attains under conditions of restricted flow.

With a nominal capacity of 8 gpm, the pump will deliver up to 18 gallons at 1000 rpm shaft speed, at pressure ranging up to 250 psi. **T-10-1252**

Gear Gage and Sorter

Automatic gaging and sorting of gears is done with this machine developed by National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. as first of a line of Red Ring gear inspection equipment for automated production lines. The machine makes up four checks on gears for both size and helix angle accuracy. If used to inspect spur or helical gears before shaving operations, the unit may be adapted to check size only.

The unit may be installed in an automated line to gage gears either before or after shaving in conjunction with the feeding device, or it may be magazine-fed and utilized as a separate gaging device.

Built-in controls shut off the shaving machine after a predetermined number of reject gears are produced—and these controls may be based either on a percentage quantity or on a specific number of successive rejects of a given type. Signal lights on a control panel

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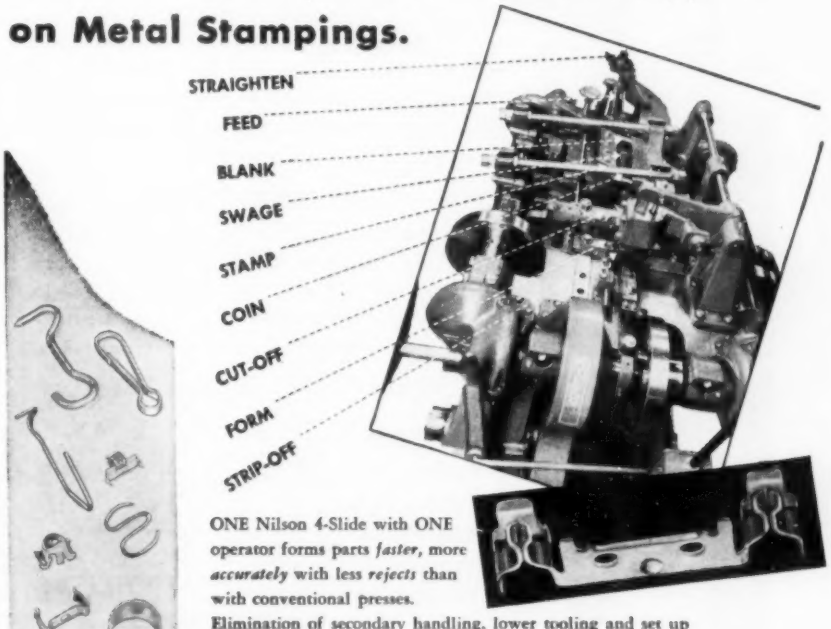
NILSON FOUR-SLIDES

Combine Operations to Lower Costs on Metal Stampings.



ONE Nilson 4-Slide with ONE operator forms parts *faster*, more *accurately* with less *rejects* than with conventional presses.

Elimination of secondary handling, lower tooling and set up costs *means added profits*. Wide range of models for wire and ribbon metals. Feed lengths to 32", stock widths to 3½". Press capacity to 75 tons.

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Automatic Chain-Making Machines • Automatic Staple Forming Machines • Wire and Strip Reels • Foot Presses • Wire Straightening Equipment • Slide Feeds for Presses

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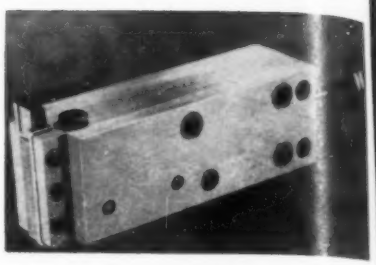
indicate which of four conditions of a gear caused shutdown of the machine—oversize, undersize, plus helix angle, minus helix angle.

Gears for inspection may be fed through the unit at rates corresponding to the production rates of rotary shaving machines. Design is so that acceptable gears collect in one container, and rejected gears sorted so that salvageable gears are separated from those that cannot be salvaged. **T-10-1261**

Self-Relieving Tool

This self-relieving tool, called the Relievomatic, for use on automatic screw machines, lathes and other machine tools is designed specifically to avoid rejects of production parts due to spirals and other undesirable marks made by cutting tools on their return passes. Simple and quick to install, on any production machine, the tool can be used with carbide, high-speed steel or



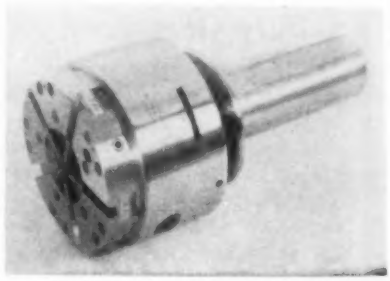
other standard tool bits up to ½ in. for turning, boring, facing and squaring operations. Two or more tool bits can be mounted in suitable adapters in the end of one Relievomatic to perform multiple machining jobs.

Features include positive self-relieving action at the end of the cutting stroke. Amount of relief can be accurately adjusted up to 0.010 in. by means of a setscrew and check nut. A radius of 0.003 can be held at shoulders. Kickover can be set at any predetermined point in the cutting stroke. It enables completing parts on automatic machines to dead concentricity.

Complete details can be obtained from the developer, Silber Products, Inc., 132 Lafayette St., New York 13, N. Y. **T-10-1262**

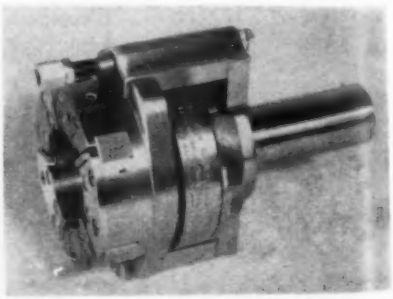
Insert Chaser Die Heads

Two die heads have been added to the line made by The Eastern Machine Screw Corp., New Haven, Conn. The light-duty size 11005 style DM insert chaser die head is designed for use on No. 2 Brown & Sharpe automatics that have 1½-in. capacity spindles for



Above. Light duty die head

Below, new addition to rotary line of automatic die heads.



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The basic economy of the inserted-blade principle, combined with the exclusive quality features of Standard Waukesha Cutting Tools, can help you reduce tooling costs on your reaming, drilling and boring operations. Cost records in all sizes and types of metal-working plants show a definite downward trend wherever these Standard Tools are used consistently.

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— for competent Cutting Tool Counsel. Waukesha sales representatives and engineers can show you how to cut your tooling costs with "Standards by Waukesha" — or help you develop special cutting tools for your unusual needs.

Representatives in Principal Cities

THESE FEATURES of Standard WAUKESHA Inserted Blade Cutting Tools Save You Money

Adjustable Inserted Blade Reamers ⅛" to 6" diameter for High Speed Heavy Duty Service. Shear-cut angle blades prevent scoring.

Inserted Blade Spade Drills 1-1/32" to 5" diameter in stock sizes. Holder lasts indefinitely, only blades need be replaced.

Replaceable Blades — at a fraction of solid-tool costs — assure long-range economy.

Interchangeability — Each size Spade Drill Holder takes ½" range of blade sizes.

Shear-Cutting Action of blades curls chips away from stock, prevents scoring, assures free cutting, requires less power.

More Grinds per Blade — More Holes per Grind.

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INSERTED BLADE REAMERS • INSERTED BLADE SPADE DRILLS • INSERTED BLADE CUTTERS • FLOATING TOOL HOLDERS • BORING BARS • SPECIAL TOOLS

A 8015-½-I

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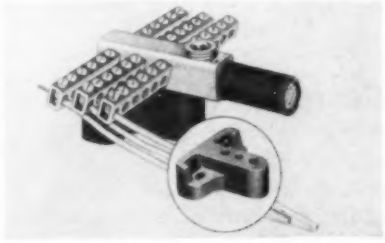
thread sizes ranging from 1⅛ to 1½ in. and where pitches are not coarser than 18 T.P.I. Carriers and chasers have the same cross section as used in the 0 size die heads but there are five chasers and carriers to a set.

The other is an addition to the rotary line of H & G insert chaser automatic die heads. It also has five chasers and carriers per set, and has a capacity of ¼ to 1¼-in. diameter. **T-10-1271**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Circuit Assembly Accessory

Ilsco Copper Tube and Products Inc., Mariemont Ave., Cincinnati 27, O., has introduced a CAN neutral bar offering several advantages in circuit assembly. Compactly built, it was designed with an eye to quick, easy mounting. By forging the circuit bars into the main line connectors at a 20-deg angle for easy wire insertion of every branch



circuit wire, the bars have been developed into units of strength and adaptability. Illustration shows CAN neutral bar on a plastic block to be used for mounting. It is sold with or without the mounting block.

The bar offers several features; they are particularly adapted to limited space; wiring is neat and simplified because wires are not crossed but connections are made parallel to each other. They are economical because of fast installation and less material required. **T-10-1272**

Electrodes for Alloy Welding

Brass, bronze, copper, cast iron and steel may be welded in flat, vertical, overhead and horizontal positions with the line of electrodes introduced by Pacific Welding Alloys Mfg. Co., 310 North Ave. 21, Los Angeles 31, Calif. Made of a high-grade phosphor bronze welding rod with a heavy black coat-

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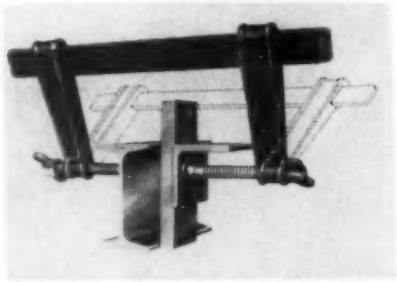
ing, the electrodes, called Phos-Bronze, offer excellent strength, corrosion resistance, low melting point, and ease of application and machining. Protective coating on the rod causes the metal to pass through the arc steadily in the same manner as do conventional shielded arc electrodes, providing a softer stable arc and lower spatter. The weld metal is kept deoxidized during the whole welding procedure because of the phosphorus content of the rod; high tin content gives greater strength, and absence of volatile elements reduces danger from fumes and smoke.

The elecrodes are useful where extensive preheating is inadvisable. They may be used with direct current—reverse polarity, and work best under low amperage-high voltage. **T-10-1281**

Double-Action Welders Clamps

Double-Action welders clamps have been specially designed by Wetzler Clamp Co., 43-15 Eleventh St., Long Island City 1, N.Y., to facilitate clamping of workpieces where the clamping surfaces are obstructed by overhanging portions.



These double-action welders clamps rest on the same principle as the Wetzler quick-action clamps, except that on the welders clamps both jaws slide freely on the high carbon steel bar, while in the latter, the head jaw is always stationary. Moreover, on the welders clamp both jaws are provided with full-length spindles, permitting a 3½-inch thrust; they thus eliminate the necessity of using shims or other filling material, as is necessary with conventional clamps in order to provide a clamping surface.

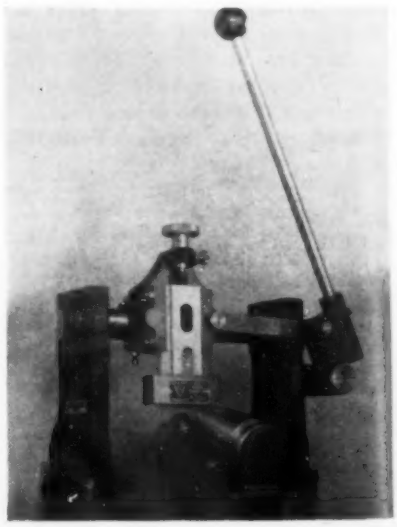
In addition, the new clamp affords the welding torch easy access to any portion of the workpiece, as the clamp may be moved out of the way readily by simply rotating it about its spindle axis as shown in the illustration. For this purpose the pressure plates of the spindle turn but do not swivel.

This line is available in throat depths of 4 inches, 5 inches and 7 inches (sizes 4, 5 and 7, respectively), the throat depth being the distance between inner bar edge and spindle center. The corresponding bar widths x bar thicknesses are 1¼ x 5/16 inch, 1½ x ⅜ inch, and 1½ x ¾ inch, respectively.

T-10-1282

Centerless Marker

The Micro-Marker, a centerless marking device, for precision calibration, marking, and brank labeling, particularly of parts when stress and plastic flow must be minimized, is offered by Acme Marking Equipment Co., Dept. 313, 8030 Lyndon, Detroit 38, Mich. It fits any standard marking press utilizing the drawbar principle. Parts to be marked rotate on a ball-bearing cradle. A mark as slight as 0.003 inch will register completely



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It actually costs less to do turning jobs on a Sheldon Precision Lathe. Machine-tool investment is cut to a fraction. Power cost is materially reduced. Less experienced operators can operate Sheldons safely and efficiently. Even cost-loadings for plant—floor space, heat and light are lower because two Sheldons can often operate in the space occupied by one large lathe.

On most "everyday" jobs a Sheldon will actually turn out more pieces per hour too. With double V-belts to the spindle Sheldon lathes deliver enough power to take heavy cuts in direct drive, at high speeds. Sheldon's "Zero Precision" Taper Roller Bearings permit work to the closest tolerances. Seldom are such extremely accurate bearings used in moderate priced lathes.

You will actually keep more as profit if you see Sheldon Lathes.

Write for Catalog

SHELDON MACHINE CO., Inc. 4229 North Knox Ave., Chicago 41, Illinois

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around the part if desired, without slippage, and with extreme accuracy.

To control depth of impression and to compensate for size variations the marking head of the Micro-Marker is mounted in a screw-type fixture capable of precise adjustment. The marking die or dies are separately mounted in the head and are available in two standard forms. Consideration has been taken to accommodate situations in which copy is to be repeated as well as frequent copy changes are expected by providing insert and solid dies.

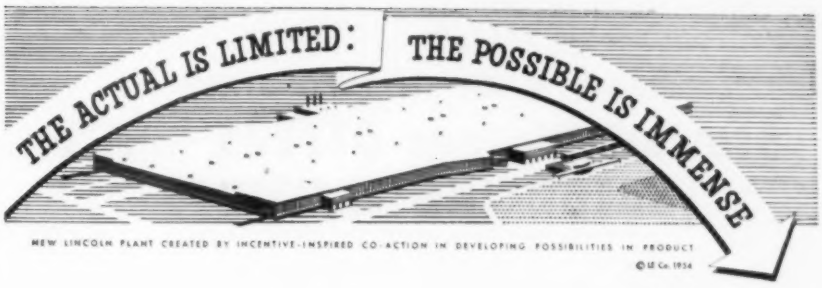
T-10-1291

Drills for Hard-to-Reach Work

Drills designed for use with flexible drive shafts or extension arms are offered by National Twist Drill & Tool Co. for drilling holes in narrow and inaccessible places, such as airframe fuselages, wing and tail surfaces, and other complex sheet metal shapes. Formerly, such drilling was done by using an adapter with a threaded shank drill; now, the two are combined in one unit, avoiding runout of the drill, difficult removal of broken drill-ends and labor in assembling. The drill's advantages include: space saving, since the new-type drill is shorter than the adapter-plus-drill assembly; better concentricity with the driving head; economy, since the new unit-with-adapter costs approximately the same as the old-style drill only. Further details may be had from the manufacturer in Rochester, Mich. **T-10-1292**

Feed for Cutting Heads

A semiautomatic power feed for the cutting heads of all chopstroke-type Stone saws has been developed by Stone Machinery Co., Inc., 826 Fayette St., Manlius, N. Y. This attachment, available either as an accessory for



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

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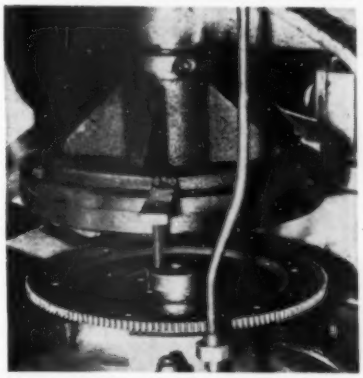

Fig. 1. Presses ring gear over flange *of flywheel web prior to welded assembly. Ring gear is ½" square steel rolled and resistance butt welded. Flange is ⅛" thick. Press is 8 ton capacity.*

CUTS COSTS

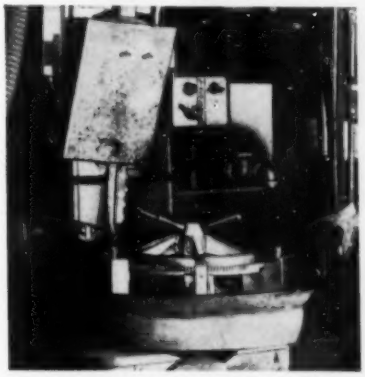

Fig. 2. Produces 8 skip welds automatically. *Operator has simply to load and unload machine. Production is approximately 30 to 45 flywheels per hour.*

HERE'S HOW

SIMPLIFIES PRODUCTION OF FLYWHEEL ASSEMBLY WITH "AUTOMATIC LINCOLNWELD"

BY a skip welding technique with "Automatic Lincolnweld", ring gears are now assembled to flywheels with minimum warping tendency. Assemblies retain circular form and flat faces within limits specified.

After pressing the ring gear to the flywheel, the assembly is mounted on a fixture (Fig. 2) for welding. Eight welds equally spaced and 1½" long are laid down. After each short bead the machine automatically indexes to a diametrically opposite side to cut warpage. The welding is done with a continuous electrode fed automatically at a predetermined speed. As the arc is hidden beneath a layer of flux, arc rays are eliminated.

Undoubtedly many production operations like this can be simplified in your plant. Why not investigate now . . . learn what new Lincoln developments will speed your manufacture and cut costs.

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Dynamic balancing an 1100 lb. rotor on a Stewart-Warner 704 Electronic Balancer.

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- both static and dynamic balancing
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MODEL 704 SPECIFICATIONS

- sensitivity within 0.04 in.-oz.-*
- capacity from half a pound to half a ton*
- any rotatable part of ½" to 44" dia.*
- only $3475.00, including operator training*
- average changeover set-up done within 3 minutes

(*Model 708 has even greater capacity ranges with nearly equal sensitivity, priced at $4975.00. Larger capacities and higher sensitivities on special order.)

You may match some of these features, but never all—and you'll never come close on price. And we will match our Stewart-Warners against the field for lifetime precision and low upkeep.

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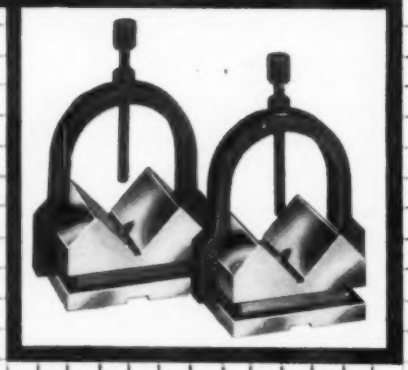
Shown here is MODEL No. 3000 (2⅞" x 3¾ x 2¹⁵⁄₁₆")
UNI-V-BLOCKS are also available as:
MODEL 5000 (4⅛ x 5⅛ x 5⅛")
MODEL 1250 (1¼ x 1¼ x 1⅜")



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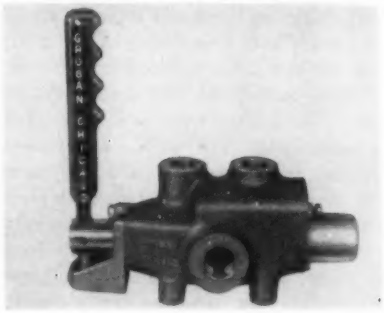
present saws or as optional equipment on all new Stone saws, operates by air with one simple control. Tests indicate that the power feed cutting head will increase production, avoid operator fatigue, and increase wheel life 10 to 25 percent, depending on metal cut. At the same time, it enables a uniform cutting speed of four seconds psi of metal cut. **T-10-1301**

Hydraulic Control Valve

Groban Supply Co., 1139 S. Wabash Ave., Chicago 5, Ill., has introduced an hydraulic control valve, Model No. 126, designed to actuate one double-acting hydraulic cylinder, or two acting as one. It is a pressure balanced sliding spool type hydraulic valve.

A self-centering feature permits the spring loaded handle to return to neutral or hold position. In this position



the hydraulic cylinder is held and the pump flow is bypassed back to the oil reservoir.

Standard pipe nipples may be used to interconnect Groban No. 126 valves, providing bank valve features at moderate cost.

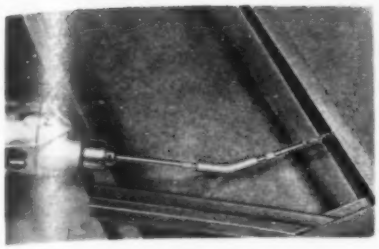
Relief valves are factory set at 1,000 psi. Pressure setting is adjustable from 750 to 1500 psi. Maximum flow capacity is 16 gpm. **T-10-1302**

Low-Cost Angle Drives

An inexpensive, easy-to-use angle drive for small diameter extension drilling and reaming, has been developed by Beaver Tool Co. of Huntington Station, Long Island, N. Y. to avoid high-cost angle driving units and flexible shafts.

Constructed for use with the "500 Series" Little Beaver drill extension rods and chucks, this angle drilling adapter simplifies reaching hard-to-get-places.

Drill change-over time is reduced to a minimum. The angle drive is quickly



installed between the drill extension rod and any of the 79 standard size drill extension chucks of the Little Beaver line, which fit all ¼-inch drive chucks.

All Beaver extension chucks fit the same threaded, 8½-inch drill extension rod and feature anti-slip design. Corresponding to standard drill sizes, they are available in number sizes from #56 to #1, letter sizes from A to H and fractional sizes from 3/64 inch to 17/64 inch by 64ths. **T-10-1311**

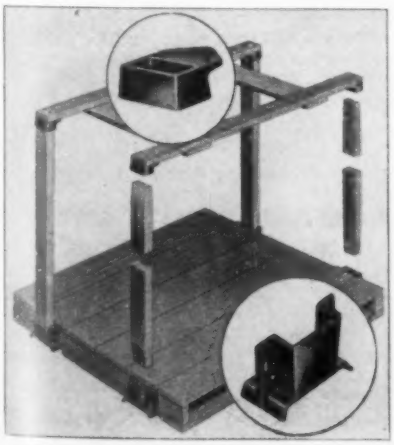
USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hardware for Building Stacking Pallets

Users may build their own stacking pallets with the V socket type hardware made by The Paltier Corp., 1701 Kentucky St., Michigan City, Ind.

Safe, flexible and inexpensive, this hardware assembles to any standard pallet. Each pallet with V socket hardware and 2 x 4-inch uprights is designed to carry a load of 1500 lb safely in a tier of three high or a total of 4500 lb, with 48-inch posts. Additional load capacity can be attained by using 3 x 4-inch uprights. Beveling of uprights and cross boards permits easy, quick, safe assembly.

Also, this hardware can be easily adapted to shelving, bins and KD boxes as well as stacking pallets. **T-10-1312**



Hard Facing Paste

Miracle Paste, a general all purpose hard facing paste, developed especially for hard facing thin blades has been announced by Mir-O-Col Alloy Co., 312 N. Ave. 21, Los Angeles 31, Calif.

It provides the optimum in wear and impact resistance, and is easy to apply.

Spreading the paste on work is readily accomplished by any flat blade such as a spatula, or putty knife, and thickness of deposit affects rate of wear only. Bonding application is by oxyacetylene or carbon arc method. Normal time required to hard face most small blades is less than 15 minutes. **T-10-1313**

Torque Motors

Reuland Electric Co., Alhambra, Calif., has developed a torque motor that can be stalled or locked, with current on, without damage to the motor. As a further feature, the unit automatically adjusts its speed to intermittent load changes while maintaining a constant power.

The motors are particularly applicable for winding film or wire on spools; closing and holding closed electrical contactors or other devices; opening and holding open brakes; and also for tandem installations where another motor sets the pace as in wind-

Quick-Change . . .

Manchester Cut-Off Tool . . .

● New P.D.Q. "Manchester" cut-off tool offers *15 SECOND* tool change. Loosen only one screw to change carbide insert. "V" design on support blade and insert makes this tool self-centering and highly accurate. Adjustable rear stop provides positive insert backing and quick adjustment after insert is re-ground.

Tools are available for turret lathes, engine lathes, automatics and cut-off machines... Write for literature and specifications covering *ALL* the new "Manchester" tool features.

PDQ

PORTAGE Double-Quick TOOL CO.

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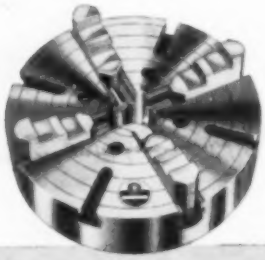

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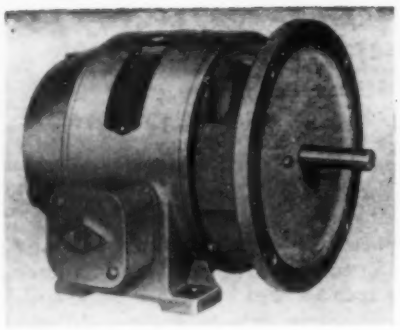
WINDSOR LOCKS, CONN.

INDICATE A-10-132-1



ing scrap as it is slit.

Ratings, in ft/lb or torque rather than horsepower, are available from ½ through 10 ft/lb with across-the-line locked service duty of 5, 10, 25, 50 and 100 percent, with maximum stalls of 5, 10, 20, 60 minutes and continuous respectively. **T-10-1321**

Copper Cleaner

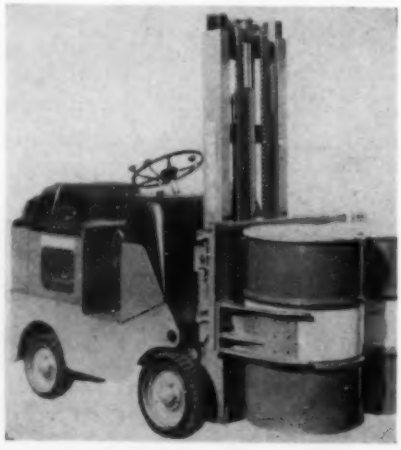
Development of Composition No. 191 for electrocleaning copper and its alloys prior to plating has been announced by Oakite Products, Inc., 158 Rector St., New York 6, N. Y.

The granular substance, which is free flowing and fast dissolving, offers long solution life, broad current-density range, a wide temperature range of 160 to 210 F, cleans at low concentrations, removes buffing dirt and other common soils quickly; rinses easily in either hot or cold water, and keeps tarnish at a minimum. **T-10-1322**

Drum Clamp for Lift Truck

Efficient, mechanical lifting, movement and stacking of drums can be accomplished with a drum clamp, designed by Towmotor Corp., 1226 E. 152nd St., Cleveland 10, Ohio.

Controlled from the operator's seat, this Towmotor hydraulic drum clamp can pick up and deposit one or two



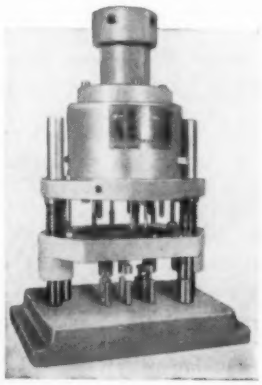
Zagar Self-clamping DRILL JIGS

NOW STANDARDIZED for DRILLING, REAMING, TAPPING

9 sizes — 5 combinations per size — for hole patterns 3" through 15" dia.

Standardization makes for quick delivery and attractive price. Only a few minor parts need be made. Speed up machining operations. The operator merely feeds the parts — the Zagar Self-clamping Drill Jig does the rest. Zagar drill jigs are now "off the shelf".

♦ ♦ ♦



Zagar drill jigs can be used in conjunction with Zagar gearless multiple-spindle drill heads to ream, drill, and tap on standard drill presses and tapping machines. Or, Zagar can quickly supply the complete "package" unit.

♦ ♦ ♦

Write for New Bulletin "E-10".

ZAGAR TOOL, INC.
24000 LAKELAND BLVD., CLEVELAND 23, O.

Zagar TOOLS For INDUSTRY and SPECIAL MACHINERY

INDICATE A-10-132-2

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-10-268	Allegheny Ludlum Steel Corp.	**Die Steels**—Four page report discusses properties and characteristics of Ontario steel. It includes information on forging, annealing, tempering, etc. and detailed laboratory data on physical characteristics. (Page 268)
A-10-242	American Broach & Machine Co. Div. Sundstrand Machine Tool Co.	**Broaches**—Catalog 450 describes American broaches, machines and fixtures. (Page 242)
A-10-264-2	American Machine & Foundry Co.	**Drill Chucks and Vises**—Folder W-50 discusses Float-Lock Vises and Wahlstrom Chucks. (Page 264)
A-10-222	American MonoRail Co.	**Crane Systems**—Bulletin C-1 illustrates and gives histories of successful MonoRail installations. (Page 222)
A-10-8	American Tool Works Co.	**Radial Drills**—Bulletin 315 gives detailed facts concerning the American Hole Wizard Radial Drills. (Page 8)
A-10-137	B. C. Ames Co.	**Dial Caliper Gages**—Catalog contains information on Ames precision measuring instruments. (Page 137)
A-10-145	Anker-Holth Div. The Wellman Engineering Co.	**Air Cylinders**—A bulletin describes the complete line of Anker-Holth products (Page 145)
A-10-191	W. F. & John Barnes Co.	**Special Machinery**—Booklet "Coordinated Machine Engineering" describes the scope of Barnes machine tool building service. (Page 190-191)
A-10-233	Bay State Abrasive Products Co.	**Abrasive Wheels**—Brochure "Tool Room Grinding Wheels" gives latest tool grinding specifications. (Page 233)
A-10-247	The Bodine Corp.	**Special Machinery**—Brochure "Bodine Presents 12 Typical Case Histories" explains how various companies have cut machine costs. (Page 247)
A-10-252	Campbell Machine Div. American Chain & Cable	**Abrasive Cutters**—Bulletin DH-301 describes Campbell abrasive cutting Methods. (Page 252)
A-10-285	Carboloy Dept. of General Electric Co.	**Cemented Carbides**—"Carboloy Die Engineering Manual" explains the advantages of carbides in dies. (Page 285)
A-10-256	Carlton Machine Tool Co.	**Radial Drills**—Bulletins describe Carlton Radial Drills. (Page 256)
A-10-259	The Cincinnati Milling Machine Co. Hydroform Div.	**Hydroforming Machines**—Bulletin M-1759-2 gives general Hydroform data, specifications and machine sizes. (Page 259)
A-10-25	The Cincinnati Shaper Co.	**Shapers**—Catalog N-6 explains improvement and advantages of Cincinnati Shapers. (Page 24-25)
A-10-114	Darwin & Milner Inc.	**Tool Steels**—Book states 25 Darwin brands and types of tool steels, gives stock size lists and other information. (Page 114)
A-10-168	Dearborn Gage Co. Ellstrom Standards Div.	**Gage Blocks**—Catalog contains complete specifications and prices on the entire Ellstrom line of gages. (Page 168)
A-10-29	The Dumore Co.	**Automatic Drill Units**—Illustrated bulletin presents specifications and construction features of the Dumore unit. (Page 28-29)
A-10-235	Eastman Kodak Co.	**Contour Projectors**—"Kodak Contour Projectors" explains how to use contour production gaging equipment and the advantages thereof. (Page 235)
A-10-266	Erickson Tool Co.	**Holding Tools**—Catalog K gives the complete story and applications for all Erickson holding tools. (Page 266)
A-10-188	Ferguson Machine & Tool Co., Inc.	**Gear Drives**—Twenty-page Catalog 105 aids engineers in selecting drives and describes the roller gear drive. (Page 188)
A-10-187	Frauenthal Div. The Kaydon Engineering Corp.	**Turning and Grinding Machine**—Bulletin 301 gives information on the series 3100 precision machines. (Page 186-187)
A-10-250-2	Genesee Mfg. Co.	**Facing and Counterboring Tools**—Catalog 54-T describes interchangeability, standards and materials used in Genesee tools. (Page 250)
A-10-18	Gisholt Machine Co.	**Balancing Machines**—Booklet "Gisholt Balancing Machines" gives full information on the Gisholt Balancing Machine. (Page 18)
A-10-19	Gisholt Machine Co.	**Superfinishers**—New catalog discusses superfinish attachments and various applications. (Page 19)
A-10-158	Handy & Harman	**Automatic Brazing Systems**—Bulletin 20 contains information about fast, low-cost production brazing. (Page 158)
A-10-236-1	Hanna Engineering Works	**Cylinders**—Catalog 750 discusses the design, construction and engineering features of Hanna fluid power cylinders. (Page 236)
A-10-5	Hardinge Brothers, Inc.	**Precision Chucking Machines**—Bulletin HC-HCT presents the entire story of Hardinge chucking machines. (Page 5)

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-10-226	Haynes Stellite Co. Div. Union Carbide & Carbon Corp.	**Cutting Tools**—Manual on cutting tool practice assists users in obtaining the advantages of Haynes Stellite tools. (Page 226)
A-10-246-2	Heinrich Tools, Inc.	**Air Vises**—Catalog points out the construction features and advantages of Heinrich Model 33 Air Vise, as well as other Heinrich tools. (Page 246)
A-10-157	B. Jahn Mfg. Co.	**Progressive Dies**—Booklet "B. Jahn Production Proved Dies!" gives many facts concerning Jahn dies. (Page 157)
A-10-209	Kearney & Trecker Corp.	**Special Milling Machines**—Data Sheet 1032 gives details of the production milling operations; 20-page catalog SMD-10 describes complete line of standard CSM Simplex milling machines. (Page 208-209)
A-10-220	Keller Tool Co.	**Air Drilling Units**—Advantages and features of Keller Series 92A tools are stated in Catalog Section 92. (Page 220)
A-10-31	Lapointe Machine Tool Co.	**Broaching Machines**—Illustrated bulletin CH-5 gives production features, construction details and advantages of Lapointe broaching machine. (Page 30-31)
A-10-175	Lavallee & Ide, Inc.	**Reamers**—"Comparative Net Price Selector" gives current prices and descriptions of tools. (Page 174-175)
A-10-293	Lempco Products, Inc.	**Die Accessories**—7th-Edition Catalog gives latest price list and describes the various Lempco products. (Page 293)
A-10-286	Lepel High Frequency Laboratories, Inc.	**Induction Heating Units**—36-page illustrated catalog contains information on high frequency induction heating. (Page 286)
A-10-129	The Lincoln Electric Co.	**Welding Machines**—Latest data on procedures and speeds of Automatic Lincolnweld are available in Bulletin 439. (Page 129)
A-10-289	Lindberg Engineering Co.	**Induction Heating Equipment**—Bulletin 1460 describes Lindberg high frequency induction heating machines. (Page 289)
A-10-160	Lovejoy Tool Co., Inc.	**Milling Cutters**—Catalog describes the various types and sizes of milling cutters. (Page 160)
A-10-238	National Broach & Machine Co.	**Small Broaching Machines**—Bulletin B54-9 discusses the cutting of oil grooves, small splines, serrations, keyways, etc. with National broaching machines. (Page 238)
A-10-162	Nelco Tool Co., Inc.	**Carbide End Mills**—New 48-page catalog describes Nelco carbide tipped end mills. (Page 162)
A-10-213	New Britain Machine Co.	**Cam Actuated Machines**—Literature describes New Britain boring machine and includes details of a variety of specific parts turned out on these machines. (Page 212-213)
A-10-109-2	Newcomer Products, Inc.	**Clamp Toolholders**—Catalog 109-54 explains production advantages and construction features of Newcomer Toolholders. (Page 109)
A-10-171	Niagara Machine & Tool Works	**Presses**—Bulletin 66 illustrates and describes the new line of Niagara presses. (Page 170-171)
A-10-149	Parker Stamp Works, Inc.	**Marking Tools**—36-page catalog "Marking Tools" gives information concerning Parker stamping equipment. (Page 149)
A-10-121	Ring Punch & Die Co.	**Punches and Dies**—20-page booklet illustrates complete line of perforating products. Detailed dimensions and prices for each size are given. (Page 121)
A-10-156	The Sentry Co.	**Electric Furnaces**—Catalog L-45 tells the full story of Sentry furnaces and the Sentry Diamond Block Method. (Page 156)
A-10-161	The Skinner Chuck Co.	**Power Chucks**—Bulletin PCF-67 discusses the nonrotating Skinner Power Chuck Fixtures. (Page 161)
A-10-135-1	South Bend Lathe	**Lathes and Shapers**—Catalog 5432 tells the various models and sizes of machine tools available. (Page 135)
A-10-248	The Torrington Co.	**Swagers**—Booklet describes in detail rotary swagers and how they may help their users. (Page 248)
A-10-254	Verson Allsteel Press Co.	**Presses**—Catalog G-52 summarizes the Verson line of presses and gives typical specifications. (Page 254)
A-10-214	Wiedemann Machine Co.	**Turret Punch Presses**—Bulletin 241 explains the advantages of Wiedemann presses. (Page 214)

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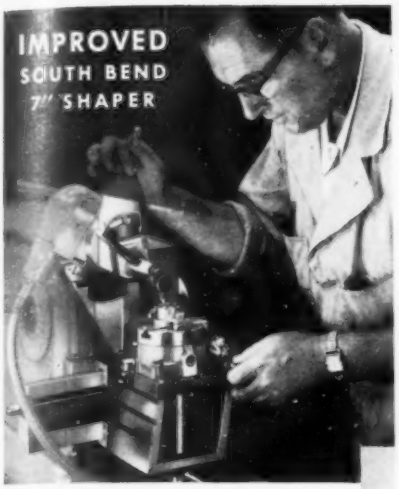
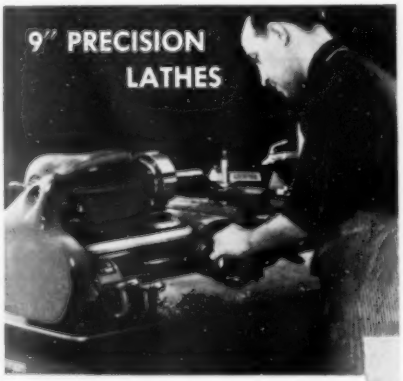
2 Top Values

for Small Work



Only 7" bench shaper with pressure lubrication of ram dovetail bearings, bull gear teeth and crank pin slide bearings—keeps wear to a minimum, helps absorb shock of intermittent cuts. This precision shaper has speed, accuracy and handling ease to produce more and better work at lower cost. Write for Catalog 5417. Factory price $551, less motor.



These popular lathes offer maximum value for your equipment dollars. Their quality and construction will give long years of dependable, efficient service on close-tolerance machining of small parts. Factory prices from $211, less electrical equipment. Write for Catalog 5432. 85 other models and sizes to choose from to meet your needs.

Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941
1941
1954
WAGES UP 150%
MATERIALS UP 130%
PRICES UP 41%
Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

SOUTH BEND LATHE

SOUTH BEND 22, INDIANA

INDICATE A-10-135-1

drums at any height within lifting range. Special curved arms fit the contour of drum sides. The inner surface of each arm is covered with ribbed rubber, which grabs and holds loads, and protects drums from damage.

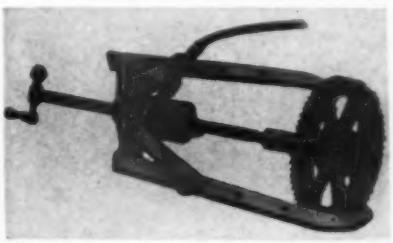
When the lift truck is required for handling other types of material, the drum clamp is easily interchanged with other clamps, or a special hydraulic operating mechanism can be detached so standard forks may be installed.

T-10-1351

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hydraulic Power Unit

Armstrong-Bray & Co., 5364-76 Northwest Hwy., Chicago 30, Ill., announces a new portable single ram hydraulic power unit for pulling or pushing gears, wheels, bearings or parts; for pulling or pushing cylinder sleeves, etc. This Hydragrip unit consists of a small-hand-operated hydraulic



pump, connecting hose and single ram hydraulic actuating unit.

This convenient size, easily portable unit develops thrusts up to 35,000 lb. A single ram, placed concentrically in the cylinder assures accurate alignment of thrust along the center line of the puller's forcing screw, and prevents wedging, binding, power loss or scoring of cylinder walls and reduces unit maintenance. Other design features of the cylinder include universal mounting brackets and spring return of ram.

T-10-1352

Fixture Key

Siewek Tool Co. has introduced a mill fixture key, which eliminates necessity of milling a slot on the bottom of a fixture. This makes for interchangeability of all fixtures to any machine table.

Further advantages provided by this design include the fact that each unit

REAMER USERS

P Q R S T

easy as

A B C

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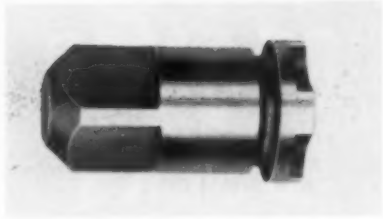
see pages 174-175

REAMER BUYERS

INDICATE A-10-135-2



has a key for two table slots. The keys have a constant stem diameter which allows a user, in building a fixture, to bore two keyholes and locate the building of the entire fixture from these holes. Since the keys are interchangeable and retained in the fixture with a lock screw similar to a drill bushing, the fixture may be moved to any machine. Complete information is available from the company, 2862 East Grand Blvd., Detroit 2, Mich. **T-10-1361**

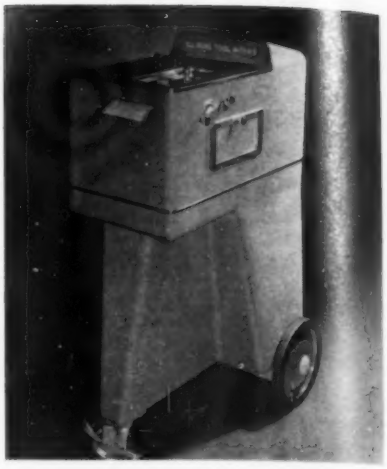
Automatic Recorder

A universal electrical recorder which produces a permanent, easy-to-read record and provides an automatic process that minimizes the chance for human error has been developed by Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill.

The machine, called Illinois Tool Works 1603 Electrical Recorder, is a complete unit, designed to equip analytical measuring machines and hob and worm lead machines for electrically recorded charts, is structurally independent of the pickup. It operates on 115 V, 60 cycles ac.

The recorder offers simplicity of form, ease of operation, ease of maintenance and good appearance.

Styled by the industrial design organization of Reinecke and Associates in collaboration with Illinois Tool Works engineering staff, the recorder provides advantages of automatic recording and graphic inspection.



All frequently used controls are located on the top control panel.

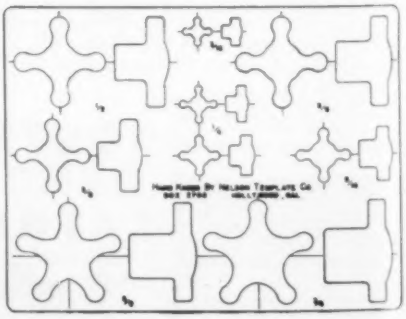
A principal feature of the over-all design is the three-point pivotal base with cutout to allow the operator to stand close to the machine during operation. To help reduce vibrations transmitted through the floor, and to provide greater moveability, a rubber wheel is mounted at each pivotal point.

Complete information on the 1603 electrical recorder is available on request. **T-10-1362**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Templates

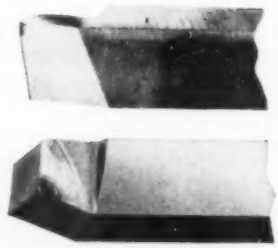
Tracing templates for use by tool and mechanical designers are offered by Nelson Template Co., Box 2708, Hollywood 28, Calif. The templates, which are made of cellulose acetate for durability, cover four patterns: handknobs (illustrated) scaled to nine sizes; wing nut, in seven sizes; thumb screw in nine sizes; and plain thumb screw in seven sizes. **T-10-1363**



• What is your operation? Gear shaping, high speed automatics? No matter . . . because Stuart Oil Company has a balanced cutting oil for you with just the right amount of lubricity, temperature control and chemical activity to provide the optimum in finish, production and tool life.

Stuart's Balanced Cutting Oils are made under laboratory control. You are assured of a uniform product that will produce the very best results obtainable under the conditions you will subject it to.

Perhaps you are blending your own cutting oils now . . . or using other types. Let a Stuart Representative, "the Man in the Barrel", explain and demonstrate a balanced Stuart Cutting Oil.
Fill in the coupon below today.



The cutting tool at top shows abnormal front clearance caused by excessive chemical activity of cutting fluid. The lower cutting tool shows cratering from insufficient chemical activity of cutting fluid.

More than a "Coolant" is Needed

D. A. Stuart Oil Co.
EST. 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2727 S. Troy St., Chicago 23, Illinois

In Canada: Canadian D. A. Stuart Oil Co., Ltd.
3575 Danforth Ave., Toronto

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL TO

D. A. Stuart Oil Company
2727-49 S. Troy Street, Chicago 23, Ill.
Have "the Man in the Barrel" call.
Send a Stuart's Cutting and Grinding Fluid Selector Folder.

NAME.....

TITLE.....

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-136

good reading

GRAPHICS IN ENGINEERING AND SCIENCE *by A. S. Levens. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $7.00. 696 pp.*

Fundamentals and applications of graphics as a language in technology are discussed in this book. The effective use of graphic elements in design, research, development and the coordination with mathematics, mechanics and strength of materials are integrated.

The author presumes a reasonable proficiency in the use of instruments, lettering and simple geometric constructions. Background reference material is contained in six appendixes.

TOXICITY OF INDUSTRIAL ORGANIC SOLVENTS *by E. Browning. Published by Chemical Publishing Co., Inc., 212 Fifth Ave., New York, N. Y. Price $8.00. 411 pp.*

This book summarizes available information of the effects on man of the various solvents used in industry.

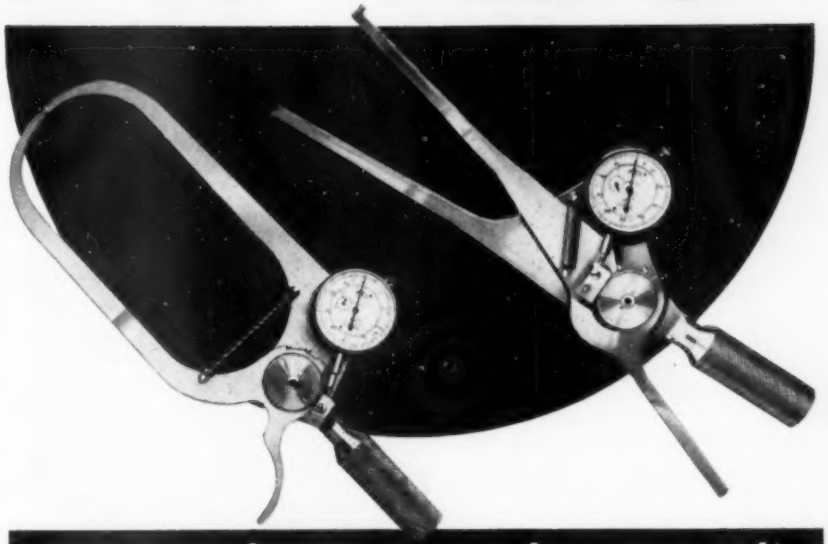
The following information is given for most solvents: chemical and commercial names, structural formula, properties, uses, vajor concentration in air, toxicity, toxic effects on humans and effects of mixtures of the solvents with other solvents.

PRACTICAL GEAR DESIGN *by Darle W. Dudley. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $7.00. 335 pp.*

This book covers all types of gears to enable engineers, designers, and draftsmen to calculate load-carrying capacities, choose materials for manufacture, seizing parts for economical production and handling gear operations under service conditions.

Practical helps are included such as: gear shaving, shear cutting, equations, curve sheets, design tables and guidance on kinds and causes of gear failures.

AMES



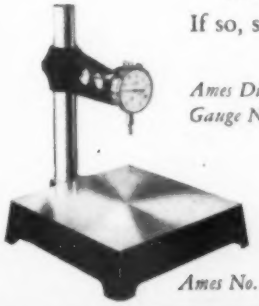
Long or Short: Curved or Straight

CALIPER GAUGES· Custom-built to fit your exact need

Whatever your measuring problem – whether it's the inside dimensions of a pipe, the wall thickness of a casting, the outside dimensions of a rocket – Ames can build the caliper gauge that fills your requirements.

Ames caliper gauges are made of carefully-finished heavy gauge steel and are equipped with an Ames exclusive: a chordal error correcting cam that assures accurate readings. Ames calipers are available with contacts of various shapes – ball, flat or pointed – made of carbide, hardened steel, or sapphire.

Your measuring problems may involve a caliper gauge. If so, send it to Ames – for a quick, profitable solution.



Ames No. 13 Dial Comparator

Ames Dial Depth Gauge No. 11B

Write for your free copy of catalog on Ames precision measuring instruments.

Ames Trutest No. 1

Representatives in principal cities. B. C. AMES CO. *30 Ames Street Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-137

Another Cleveland Design to Speed Production!

CLEVELAND NUT TAPPING MACHINE

OPERATION: Core drill and tap cast iron nuts ⅝" through 1½"

Produces 1020—⅞"—9 Pitch Cast Iron Nuts per hour @ 100% Efficiency

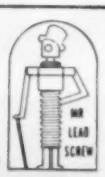
DESCRIPTION: A vertical F-2 type Cleveland Heavy Duty Machine with eight spindle multiple head and a double slide four track feeder. The feeder fixture has a double slide mounted on hardened and ground slide bars to slide back approximately 3½" picking up a new part at end of each four tracks and at the same time picking up the drilled part at the drill position; then to slide forward to a fixed position and hold the parts at drill and tap position; at the same time the finished parts will be discharged onto a delivery chute at the rear of the tap spindles. The operator loads the nuts from a large tray in front of machine into magazine.

Send for your copy of this Guide

Write today for Catalog No. **TE-104**

CLEVELAND tapping machine co.

A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC. • CANTON 6, OHIO



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-138

CAMS—DESIGN AND LAYOUT *by Louis Kasper. Published by Chemical Publishing Co., Inc., 212 Fifth Ave., New York, N. Y. Price $3.50. 101 pp.*

The author has given sufficiently detailed explanations of cam designs for intelligent application, but without cumbersome calculations. Although the book may serve as a reference, the greatest benefit will be derived if the layout examples are actually performed.

HOW TO USE PORTABLE POWER TOOLS *by Maurice H. Reid. Published by Thomas Y. Crowell Co., 432 Fourth Ave., New York 16, N. Y. Price $2.95. 210 pp.*

The use and maintenance of portable power tools is discussed in this book. It contains information about all methods of employing the drill, combo tool, router-shaper-planer, sanders and other tools. Time-saving job short cuts are given.

Advice is included on what tools to get for specific requirements, and how to oil, sharpen and care for tools.

ANTI-FRICTION BEARINGS *by Hudson T. Morton. Published by Hudson T. Morton, 815 Wildt St., P. O. Box 355, Ann Arbor, Mich. Price $7.75. 395 pp.*

This up-to-date textbook presents facts concerning anti-friction bearings. Data is given in simple language for the bearing user but is complete enough to be useful to machine designers.

Among the bearing facts included are: designs, types, load consumption, capacity, applications, lubrication, mounting and installation and history. Four hundred illustrations and tables are included.

MACHINABILITY REPORT, *Vol. 3 by James Van Voast. Published by Curtiss-Wright Corp., Wood-Ridge, N. J. Price $4.60. 153 pp.*

Sponsored by the United States Air Force, this book discusses the machining of titanium. It should enable production planners to make accurate estimates of machine tool needs, cost and productivity as soon as experimental prototypes pass their tests.

Speed and feed recommendations, together with suggested tools, tool angles and types of cutting fluids are given for major machining operations. Horsepower and surface results are also included.

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Oct. 4-6. National Electronics Conference. Sponsored by AIEE, IRE, Illinois Institute of Technology, Northwestern University and University of Illinois. Hotel Sherman, Chicago, Ill. Send inquiries to AIEE office, 36 W. 46th St., New York 36, N. Y.

Oct. 4-9. Society of Automotive Engineers. National aeronautic meeting. Statler Hotel, Los Angeles, Calif. Contact society office, 29 W. 39th St., New York 18, N. Y. for details.

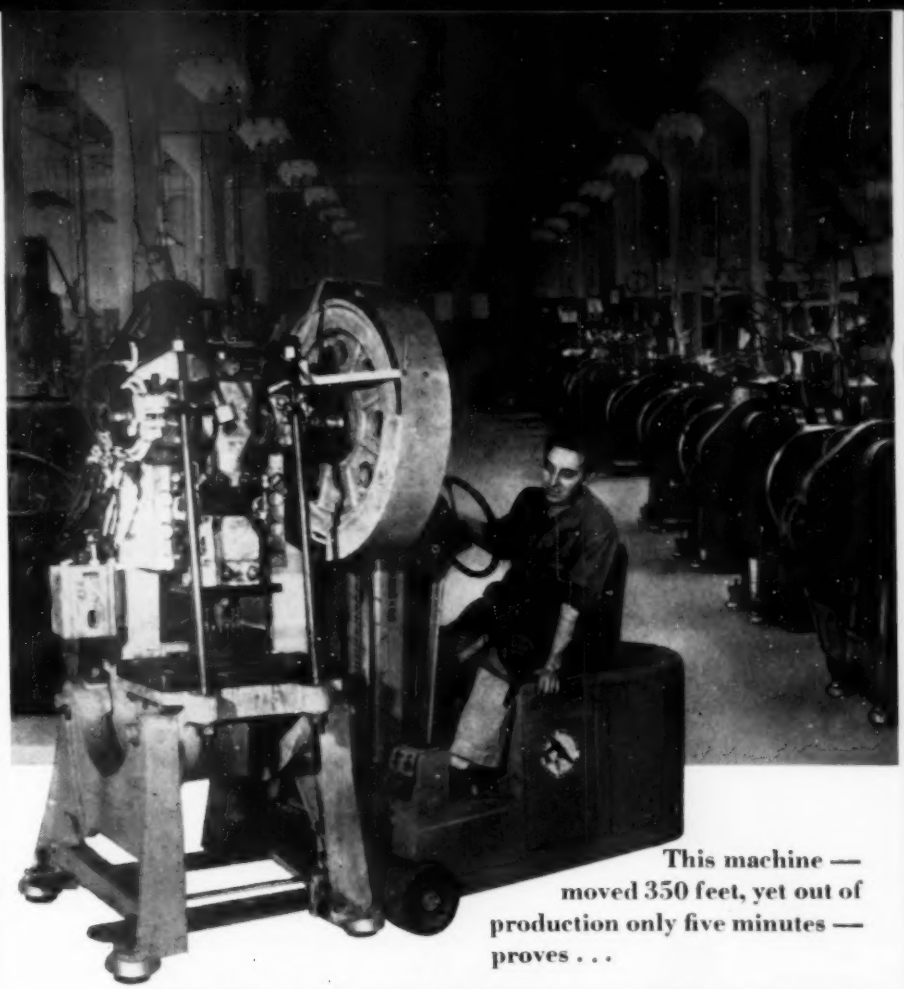
Oct. 11-15. American Institute of Electrical Engineers. Fall general meeting, Morrison Hotel, Chicago, Ill. For more information contact institute office, 36 W. 46th St., New York 36, N. Y.

Oct. 12-15. National Association of Corrosion Engineers. Annual south central regional conference. Adolphus Hotel, Dallas, Texas. Write association office, 1061 M & M Bldg., Houston, Texas, for more details.

Oct. 14-15. Illinois Institute of Technology. Tenth annual National Conference on Industrial Hydraulics, Sheraton Hotel, Chicago, Ill. Direct inquiries to Institute, Technology Center, 35 W. 33rd St., Chicago 16, Ill.

Oct. 18-19. American Society of Mechanical Engineers and American Society of Lubrication Engineers. Joint lubrication conference, Lord Baltimore Hotel, Baltimore, Md. Direct inquiries to D. F. Wilcock, General Electric Co., General Engineering Laboratory, 1 River Rd., Schenectady, N. Y., or to the ASLE, 84 E. Randolph St., Chicago 1, Ill.

Oct. 21-22. Illinois Institute of Technology. Fifth annual National Noise Abatement Symposium, to be held on the Institute's campus, Chicago, Ill. Get more details from Institute office, Technology Center, 35 W. 33rd St., Chicago 16, Ill.



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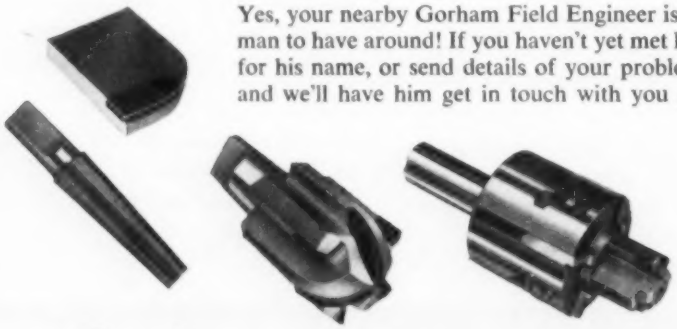

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Oct. 21-23. AMERICAN SOCIETY FOR QUALITY CONTROL. Eighth New ng-land Conference, Ten Eyck Hotel Albany, N. Y. For additional inform ion contact Southern Connecticut Sec ion, ASQC, Box 1681, Bridgeport 1, C nn.

Oct. 25-27. AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Machine Tool Conference, Statler Hotel, Det oit, Mich. Direct inquiries to institute office, 36 W. 46th St., New York 36, N. Y.

Oct. 25-29. X-RAY DIFFRACTION SCHOOL, held annually by Research & Control Instruments Div., North American Philips Co., Inc. to be conducted at the Knickerbocker Hotel, Chicago, Ill. Will cover power camera, X-ray Diffractometer and X-ray Spectrograph techniques. Get details from company, 750 S. Fulton Ave., Mount Vernon, N. Y.

Nov. 1-5. AMERICAN SOCIETY FOR METALS. Metal Show, International Amphitheatre, Chicago, Ill. Get more data from society headquarters, 7301 Enclid Ave., Cleveland, Ohio.

Nov. 1-5. AMERICAN WELDING SOCIETY, National fall meeting, Sherman Hotel, Chicago, Ill. Further details are available from society office, 33 W. 39th St., New York 18, N. Y.

Nov. 2-3. INDUSTRIAL FURNACE MANUFACTURERS ASSOCIATION. Sponsors of sessions on practical industrial heating coincidentally with National Metals Congress and Exposition, Chicago. Request details from association office, 412 5th St., N. W., Washington 1, D. C.

Nov. 3-4. INVESTMENT CASTING INSTITUTE. National meeting, Congress Hotel, Chicago, Ill. For complete details contact institute headquarters, 27 E. Monroe St., Chicago 3, Ill.

Nov. 4-7. NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION. Annual convention, Biltmore Hotel, Dayton, Ohio. Complete information may be had from association headquarters, 907 Public Square Bldg., Cleveland 13, Ohio.

Nov. 15-17. AMERICAN STANDARDS ASSOCIATION. Fifth national conference on standards. Hotel Roosevelt, New York, N. Y. For more information, contact association headquarters, 70 E. 45th St., New York 17, N. Y.

Nov. 28-Dec. 3. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, Statler Hotel, New York, N. Y. Complete particulars are available from the society offices, 29 W. 39th St., New York, N. Y.

Readers' Viewpoints

. . . depreciation allowances

To the Editor:

The new tax law which President Eisenhower signed on the 16th of August contains a large number of long overdue reforms. That section which liberalizes depreciation allowances is of prime importance to industry. The evils of the Treasury Department's Bulletin F are well-known, but few people realize that the burden was largely on small and growing businesses. Big business has always had the records and the wherewithal to set realistic depreciation schedules. Thus, the new law will help the small and growing enterprise obtain a faster recovery of capital, and this in turn, should be good for the economy.

Because it feared a large loss of revenue, Congress was reluctant to give businessmen the option of setting depreciation schedules without restraint. The "Declining Balance" and "The Sum of the Digits" methods in the new law appear to be intermediate steps between the old regulations and complete optional depreciation.

Businessmen will be well advised to keep their eyes directed on the actual loss of revenue that comes about as a result of the new law. If the revenue loss this year does not come up to the estimates expected by Congress, there will then be good reason for additional liberalization.

Now that we are moving in the right direction, let's keep the ball rolling.

Ralph E. Cross
Executive Vice President
The Cross Company
Detroit, Michigan

To the Editor:

Although it is true that the legislation contained in HR 8300 does contemplate liberalized depreciation allowances, will the intent of the legislation be achieved if industry is going to continue to be hag ridden by the Treasury Department's Bulletin F?

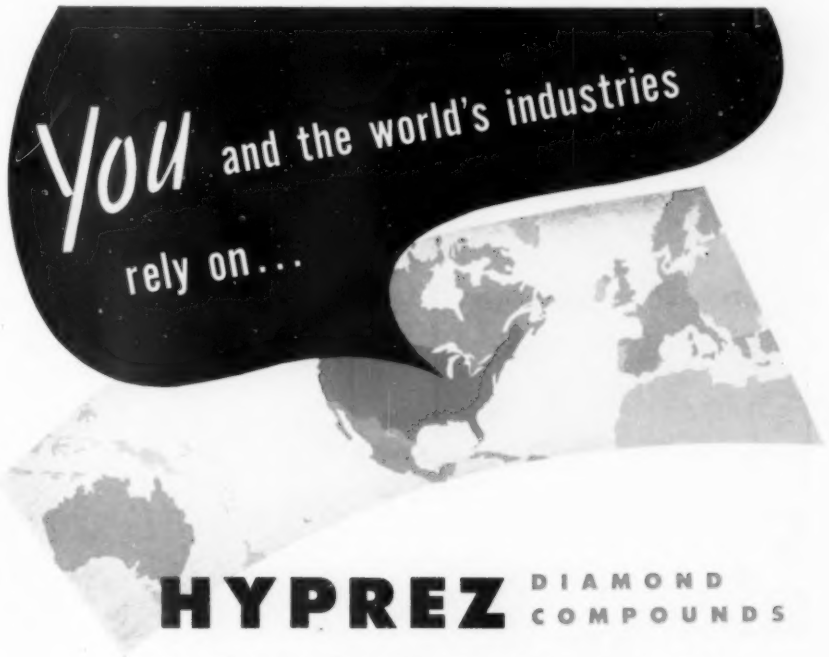
J. A. Bradner
The Lees-Bradner Company
Cleveland 11, Ohio

To the Editor:

It is my feeling that our lawmakers have done an excellent job in going as far as they have in the direction of the liberalization of depreciation formulas. I think we all understand and appreciate the practical difficulties under which they have labored.

It is difficult to resist the feeling, however, that we still have a long way to go in this field, and that this country should continue considering the problem until the day comes when control of depreciation policy is once again entirely in the hands of the individual businessman, and he can decide for himself what is best suited for the needs of his organization.

Henry D. Sharpe, Jr.
President
Brown and Sharpe Mfg. Co.
Providence, R. I.



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. . . contracting tool design

To the Editor:

All over the United States can continually be heard the moans and groans of corporate executives who have tried outside tooling sources. Their complaints range from the fact that they weren't overly satisfied, all the way up to the fact that they feel they have been swindled.

These gentlemen operate like businessmen in every phase of their business. They don't spend their money foolishly—purchase from reliable sources that guarantee their work. They keep good control of the work that is being done for them so that the cost cannot go out of control.

Why do these same men sign up with blank-check, hourly rate contracts; sit back and pay no attention to them; then complain at the end that the results weren't correct?

Below are some simple steps for any business executive to follow to make sure that his tooling service that is performed on the outside is of better quality and lower price than he can do in his own plant.

First, he must get a firm bid price from his tooling source.

Secondly, he must insist that every tool design is guaranteed accurate, both dimensionally and functionally, and that the tool design service will pick up the tab for every cent of rework that is caused by their error.

Next, he must always get a firm price commitment on each and every change as it comes through. There is no doubt that in the tooling business, as well as many other businesses, there has been the tendency of many fly-by-night operators to bid the job at a low cost so the changes can be capitalized on to make sure that there is a profit.

If the customer does not have the capacity to build these tools that he has designed on the outside, he should go to a company that will design and build them on a firm bid, guaranteed-result basis. He should also insist that the vendor prove out each tool and send in sample parts for inspection prior to delivery of the tools.

Whenever possible, give a complete package for a whole assembly or for a large subassembly section so that one vendor does the complete job. Then he's responsible for the coordination of assembly tools and the complete performance of all tools in the package. This eliminates buck-passing.

When possible, it's sensible for the purchaser to visit the offices and plant of the tooling source without advance notice to be certain that the tooling source has adequate personnel and equipment on their own premises to perform the work.

As deliveries are so important, the tooling source must be required to give a firm bid on the delivery date as well as the price, and to financially guarantee both the price, performance and the delivery.

These rules seem simple. They are common business practices, which are followed in all other phases of industry. Most of the complaints that are laid against the tooling service companies are the prime responsibility of you the purchaser.

John A. Frink
President
Mechaneers, Inc.
Bridgeport, Conn.

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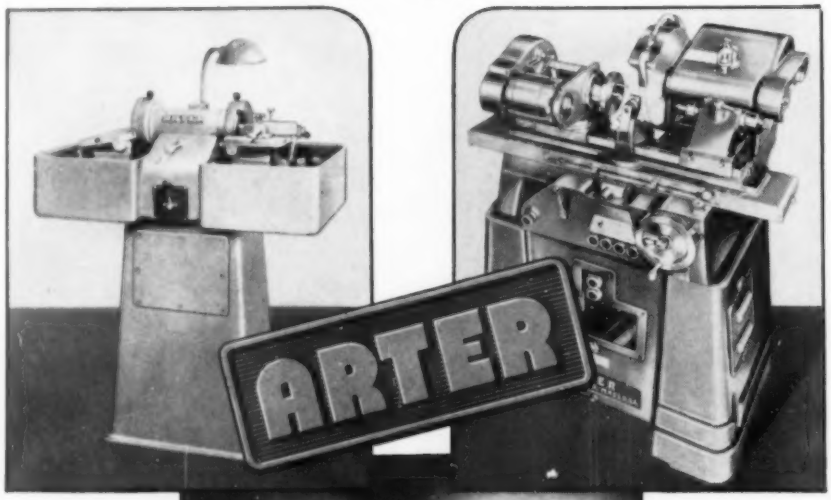

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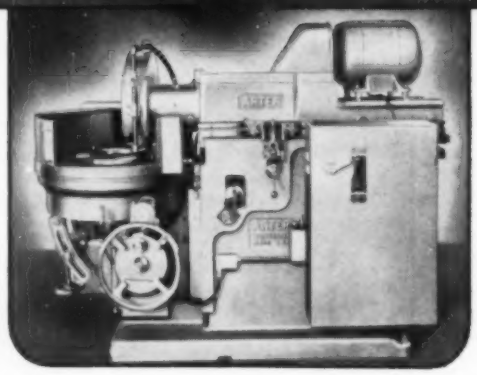

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abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Thread Rolling

Thread rolling was first suggested as far back as 1877 by Henry Simon of Manchester, England, who obtained a patent for rollers rotating in opposite directions. He also conceived of thread rolling between two flat pieces reciprocating in opposite directions, according to W. Sternke in Issue No. 7 of *Werkstatt und Betrieb*, 1954. The author, in a survey of the development of thread rolling processes attributes the successful application of this method of producing threads to the hydraulic adjustment of one of the rollers and to rotation of the two rollers in the same direction.

Thread rolling requires a gradual increase in the pressure exerted by the roller which is crosswise fed into the workpiece while the second roller is rotating freely, that is without a feed motion. Photomicrographs of rolled threads show that the material is compressed at crest and root and that the sides have a surface finish similar to that of ground and polished threads. The workpiece is supported by a guide as in the case of centerless grinding operations. Rollers are made of chrome-steel and can be used for producing threads of high accuracy on materials up to about 150,000-psi tensile strength and up to pitches of ⅛ inch. The length of the thread cannot be greater than that of the roller since the roller has no axial motion. Recently, the process has been improved by making it possible to roll two threads simultaneously on the same workpiece.

Analysis of Metal-Cutting Data

Analyses of 850 turning operations in an automobile plant are described in an article by W. Leyensetter and H. Stoehr in the July issue of *Werkstatt und Betrieb*. The authors tabulated the tool angles used, the work materials which were machined on single purpose

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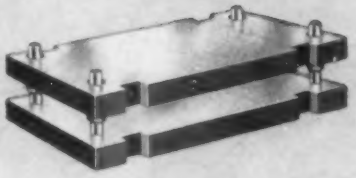

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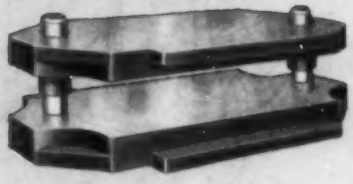

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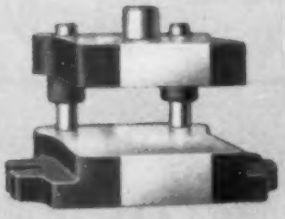

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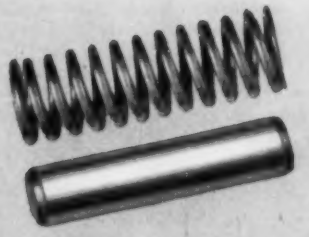

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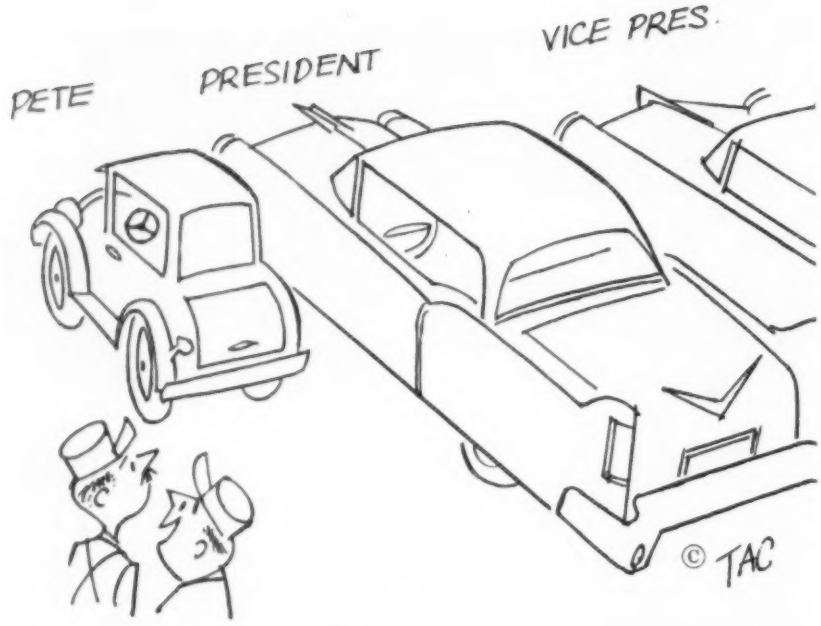

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lathes and automatics and also analyzed the distribution of the heat treatment of the materials.

They found that the clearance angle was 8 degrees and over in about 50 percent of the cases, though best results were obtained with clearance angles of 5 degrees when machining steel and cast iron with carbide tools. It was therefore recommended that instructions to the tool grinding department be changed and clearance angles be checked more carefully.

The true rake for machining cast iron lay mostly between zero and 6 degrees. Angles greater than 8 degrees could be traced to regrinding of tools by operators. The findings refer only to relatively small chips of less than ⅛-inch depth of cut and less than 0.012-inch feed per revolution covering about 95 percent of the machining operations which were analyzed.

Data showed that by far the greatest number of operations involved machining cast iron parts (206 out of 850 cases). Next was Mn-Cr steel in 69 operations. The remaining machining operations covered a surprisingly great number of materials; namely, 73 metals and some plastics. The authors indicate that similar investigations will be made in other industries for the purpose of standardization of tools and materials, and also in order to guide metal-cutting investigations and machine tool design in the most desirable direction.

International Meeting on Welding

An international meeting on resistance welding was held in April, 1954 under the sponsorship of the German Welding Association according to a report published in *Werkstatt und Betrieb*, Issue No. 7, 1954, by W. Brunst. Papers were presented by the author of the report and also by E. Gut (Switzerland), G. Sinn (Germany), G. M. Moressee (France), E. Wegemann (Switzerland), O. Gengenbach (Germany) and W. Glage (Germany).

The United States was indirectly represented, so to speak, because the paper read by Moressee dealt largely with American welding practice in airplane construction. G. Sinn discussed new electronic devices developed for control of welding machines. These devices have the advantage of inertia-free application of the current and permit rapid and frequent interruptions of the current without wear which occurs in the case of mechanical control.

Wegemann's paper dealt with the development of modern butt welding machines; Gengenbach contributed a discussion on the advantages of direct

rent in resistance welding, while ge covered the losses in electric rgy occurring in welding operations d demonstrated experimentally means reducing these losses.

Carbide Meeting

A meeting on the development of carbide tools and on other applications of carbides was held at Essen in April, 1954, as reported by W. Kienzle in the July issue of *Werkstattstechnik und Maschinebau*. Ten papers were presented. G. Vieregge, when discussing carbide application to metal cutting, indicated that the German carbides Nos. H1 and H2 are wear resistant types permitting temperatures up to about 2200 F. Cutting fluids and lubricants fail to improve the cutting performance of carbides according to the speaker. K. Hinrichs, in another paper, discussed the application of carbides to rockdrilling in the Ruhr District, where about 6 million bores are drilled every year in coal mines. The newest development consists in a combination of drilling (rotation) and hammering (oscillation) with a carbide tool.

J. Hinnueber contributed a paper on the properties of carbides at elevated temperatures. He is testing carbides with chromium or titanium basis with additions of tantalum carbides or chromium carbides respectively, which give high corrosion resistance combined with high wear resistance. He also indicated that it is possible to spray carbides on another base metal. The surface is free of pores but cannot be reground because spraying can be used only for layers less than 0.004 inch thick.

A new carbide electrode was described by O. Knotek; it is used for depositing carbides at places subjected to substantial wear on machine parts.

Electronic Control of Presses

The load applied to a press or similar machine tools for plastic deformation of metals requires control in order to avoid damage to its parts and to utilize its full capacity for high productivity, according to H. Maekelt writing in the magazine *Werkstattstechnik und Maschinebau*, Issue No. 7, 1954.

He has developed an electronic instrument which shows automatically the load at which the machine is operating by means of strain-gages and an oscilloscope. The instrument can also be used for determining forces required for drawing and pressing of metals at various speeds, blank thicknesses, and also for observation of forces in forging and similar operations.

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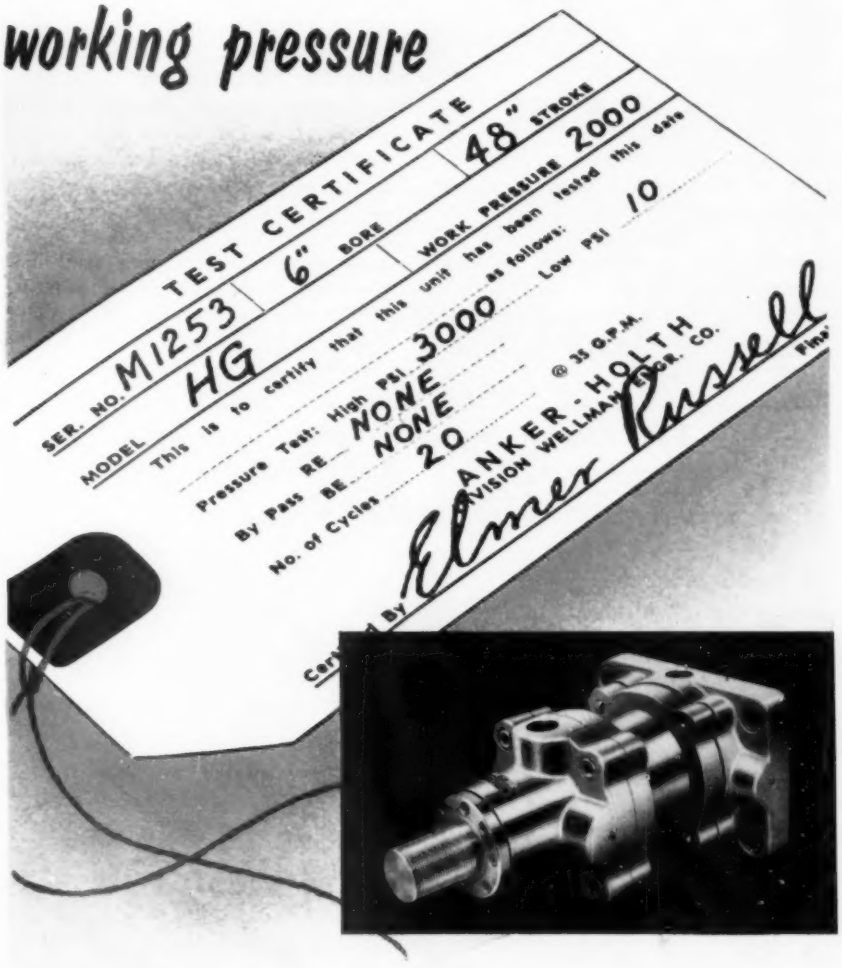

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Zirconium

Pocket size manual, "Facts About Zirconium" offers concise information on history and production of zirconium; also covers mechanical, chemical and physical properties; fabrication facts such as melting, forging, rolling, machinability, etc.; data on its technical aspects such as atomic and nuclear properties. The Carborundum Metals Co., Inc., Niagara Falls, N. Y. **L-10-1**

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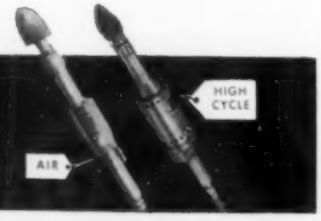

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Tumbling

"Modern Precision Tumbling" describes SlideHoning process for metals, plastics, castings and parts often considered impractical to finish in tumbling machines. Outlines special points of the process, its features and advantages. BMT Mfg. Corp., 130 E 9th St., Elmira Heights, N. Y. **L-10-3**

Control Units

Complete instrumentation for pH measurement and automatic control offered in bulletin Z1304 containing drawings and photos of installations plus detailed drawings on different methods of installing various instruments for pH measurement. The Bristol Co., Waterbury 20, Conn. **L-10-4**

Truck Operation

"Do's and Don'ts" of safe operation of industrial trucks are presented in illustrated literature which also outlines suggestions useful for operator training. The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, Ohio. **L-10-5**

Casting Resins

Slide-rule type conversion chart computes amount of resin and accelerator needed to produce a given cast phenolic part of any size. Includes a table showing percentage by weight of appropriate hardener for use with each resin. Also gives data outlining suitable applications for each resin. Marblette Corp., 37-21 Thirtieth St., Long Island City 1, N. Y. **L-10-6**

Bushings and Hubs

Eight-page bulletin gives photos, cross-sectional drawings, tabulations of dimensions and specifications and general descriptions included in 8-page brochure on Taper-Lock bushings, hubs and adapters. Dodge Mfg. Co., Mishawaka, Ind. **L-10-7**

Metal Cleaning

Catalog covers company's cold solvent type metal cleaning equipment explaining its construction, operation, advantages, uses and accessories. Illustrated. The Graymills Corp., 3705 N. Lincoln Ave., Chicago 13, Ill. **L-10-8**

Diamond Wheels

Forty-four page catalog 55, illustrated with cross-sectional dimensional drawings for accurate type-reference, deals with complete line of Jetaline and RoBot resin diamond grinding wheels; gives wheel facts and application information, details on mounting, proper grinding speeds and feeds, and other operational data. Includes complete specification lists, with price for each type. Request on factory letterhead direct to Action Diamond Tool Co., 4545 W. Grand Ave., Chicago 39, Ill.

Powder Metal

Bulletin No. 1 gives introduction to art of powder metallurgy; describes general types and characteristics of metal powder offered by company; stresses large number of grades required for different applications; outlines major uses in industry for metal powders. Illustrated. Plastics Metals Div., The National Radiator Co., Johnstown, Pa. **L-10-9**

Hardness Testers

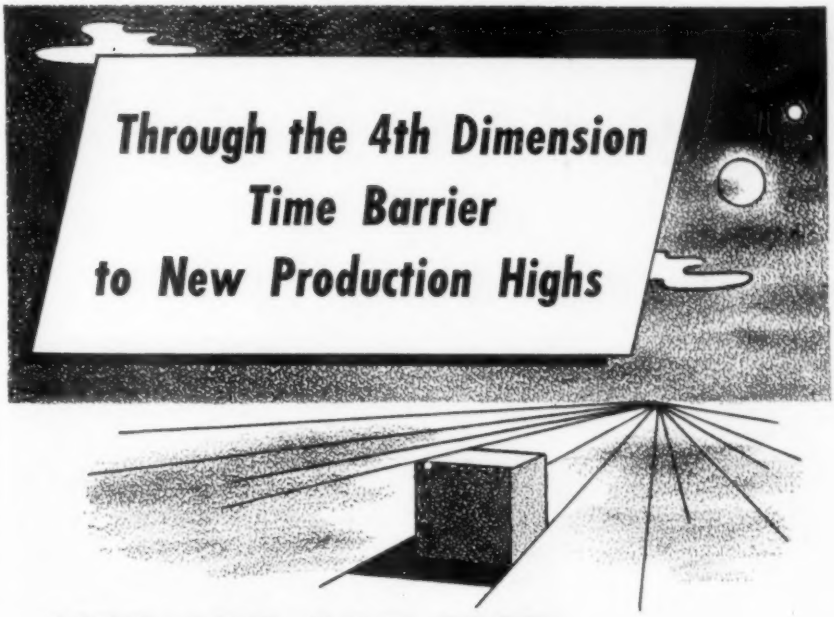
Illustrated catalog offers comprehensive coverage of complete line of Rockwell hardness testers (including the normal hardness tester, superficial tester, accessory and special tester, and the micro and macro hardness testers) giving engineering data, uses and design features. American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn. **L-10-10**

Beryllium Copper

Basic information about beryllium copper alloys presented in 4-page folder including graphs and charts of engineering properties and tempers for this metal supplied by the company. Discusses heat treating of these alloys, and outlines typical industrial applications of beryllium copper strip. Industrial Div., American Silver Co., Inc., 36-07 Prince St., Flushing 54, N. Y. **L-10-11**

Compressor Maintenance

Leaflets make up series of "Trouble Savers" designed to encourage preventive maintenance of pump equipment; explains reasons for operating trouble and ways in which they can be prevented. Mailer L-676-M1 locates trouble points in vertical water-cooled air compressors; while other similar leaflets (PC-305 and PC-306) cover centrifugal, rotary, regenerative turbine and steam pumps and water-cooled and air-cooled air compressors. All effectively illustrated with cartoon type drawings. Adv. and Sales Promotion Dept., Worthington Corp., Harrison, N. J. **L-10-12**



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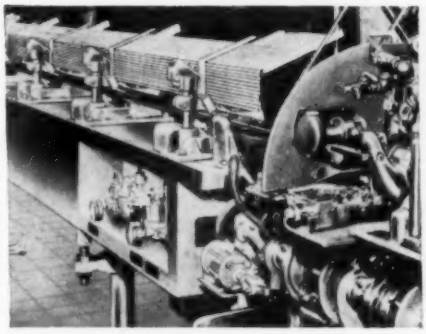
gears machine production to the steady flow of Time

ALL industrial results are achieved in Time . . . *vital 4th dimension that measures output, costs, profit.* Shorten the time gap between operations . . . shorten the time when machines are "cutting air" . . . keep machines producing at a steady optimum rate during the fatigue slow-down from 10:30 to noon, and from 3 P.M., till closing time . . . *and you are getting 4th Dimension production.* Production that is geared to the steady flow of Time.

Lipe AML Bar Feed Produces from 30% to 100% More Output by Eliminating Time Losses . . .

Time losses account for the enormous differences in output among workmen. By eliminating these losses automatically, the Lipe AML Bar Feed boosts overall production from 30% to 100%. That's because stock is fed to the machine independent of the operator. Constant pressure behind the stock assures uniform speed of feed. No feed fingers to fail or mar stock. No multiple feed-outs, even on the longest pieces.



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Syracuse 4, N. Y.

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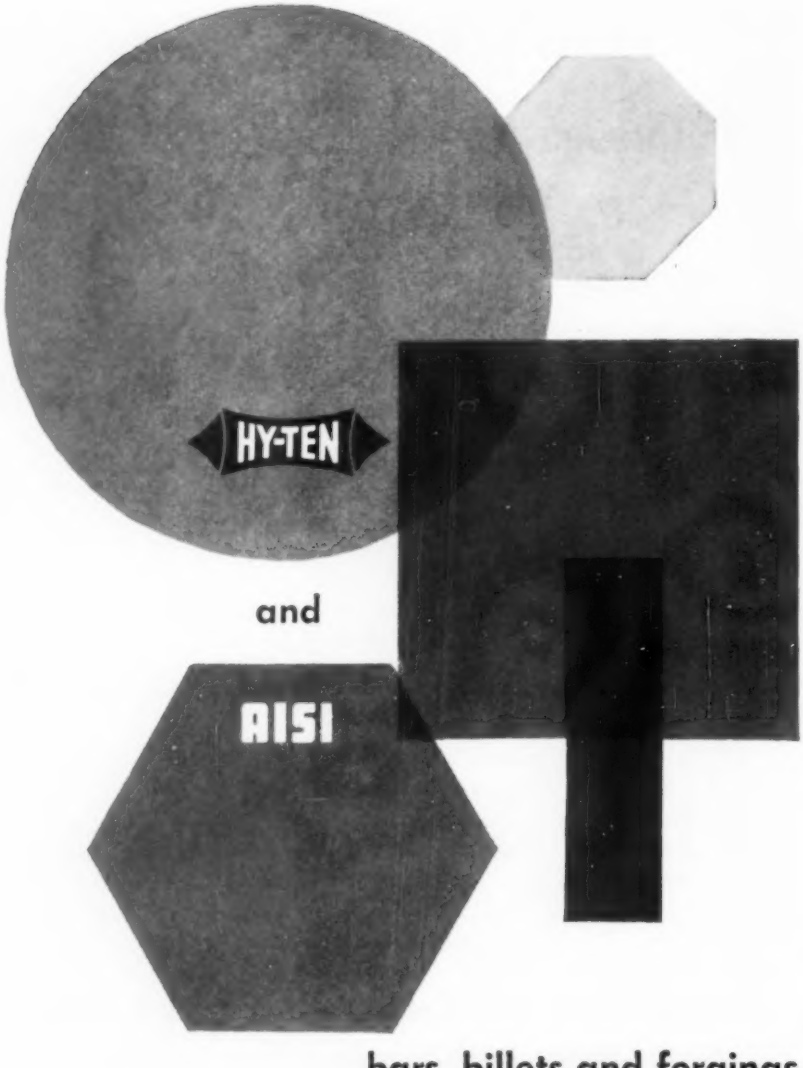

bars, billets and forgings
in sizes, shapes and treatments for every need!

Wheelock, Lovejoy & Company, Inc., can fill your alloy steel requirements promptly. This applies to both standard AISI and SAE steels and to our own HY-TEN steels—"the standard steels of tomorrow". Take advantage of our seven strategically located warehouses. All of them can supply these steels in the form and quantity you need. Every warehouse, too, is staffed with expert metallurgists who are ready to serve you.

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136 Sidney Street, Cambridge 39, Mass.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-148

Turret Stop Indicator

Illustrated folder describes recently developed Sure-Stop turret stop indicator pointing out its special advantages of precision performance and economy. D-S-C Machine Co., 29 Bertel Rd., Mt. Vernon, N. Y. **L-10-13**

Packings

Six bulletins, each featuring essential data on individual types of packings, have been compiled as aids to designers, engineers and maintenance men. E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. **L-10-14**

Lubricant Application

Field Report 134, "Application of Molykote by the Tumbling Process" describes in detail process of bonding various lubricating films, preparation of work surfaces and suitability of various peening methods. The Alpha Corp., 179 Hamilton Ave., Greenwich, Conn. **L-10-15**

Titanium Alloy

Four-page folder gives complete physical properties and forging recommendations for titanium alloy developed for bar and forging applications. Mallory-Sharon Titanium Corp., Niles, Ohio. **L-10-16**

Plant Maintenance

"Plant Maintenance Cleaning Guide" provides charts listing recommended cleaning materials, methods of application, concentrations and other pertinent details for specific cleaning jobs. Concise, designed for quick reference. Oakite Products, Inc., 158 Rector St., New York 6, N. Y. **L-10-17**

Rotary Filing

Rota-File cutting tools for applications on metal, plastic and wood products, covered in illustrated brochure showing line of rotary files with their dimensions and specifications. Rota-File Corp., 1974 66th St., Brooklyn, N. Y. **L-10-18**

Presses

Two extensively illustrated brochures on presses. Catalog 9-D covers straight side single crank presses in capacities from 50 to 400 tons, which incorporate JIC specifications. Catalog 12-B deals with single, double and nongeared knuckle joint presses in capacities ranging from 75 to 10,000 tons. Both brochures give details of dimensions, specifications, special features and applications. E. W. Bliss Co., Canton, Ohio. **L-10-19**

Plating

Sixteen-page booklet explains Flame-Plating process, its advantages, properties and applications and gives specifications for the tungsten carbide coating. Discusses areas suitable to this coating; also covers economics of this process. Linde Air Products Co., Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y. **L-10-20**

Threading Heads

Bulletin F-80-5 includes detailed data on line of hardened and ground die heads; describes design features, operation and advantages; gives drawings, specifications and dimensions for each type and for the chaser holders. Illustrated. Landis Machine Co., Waynesboro, Pa. **L-10-21**

Flute Grinding

Bulletin 654, dealing with flute grinding describes company's machine for this work, its construction features and advantages. Also explains importance of uniform rake or hook angle and accurate indexing and offers data to show how these advantages can be achieved. Illustrated with how-to-do-it photos and diagrams. Edward Blake Co., West Newton, Mass. **L-10-22**

Temperature Indicators

Instruction leaflet explains in detail uses and advantages of Tempilstiks for heat indication, etc. in metalworking industry. Tempil Corp., 132 W. 22nd St., New York 11, N. Y. **L-10-23**

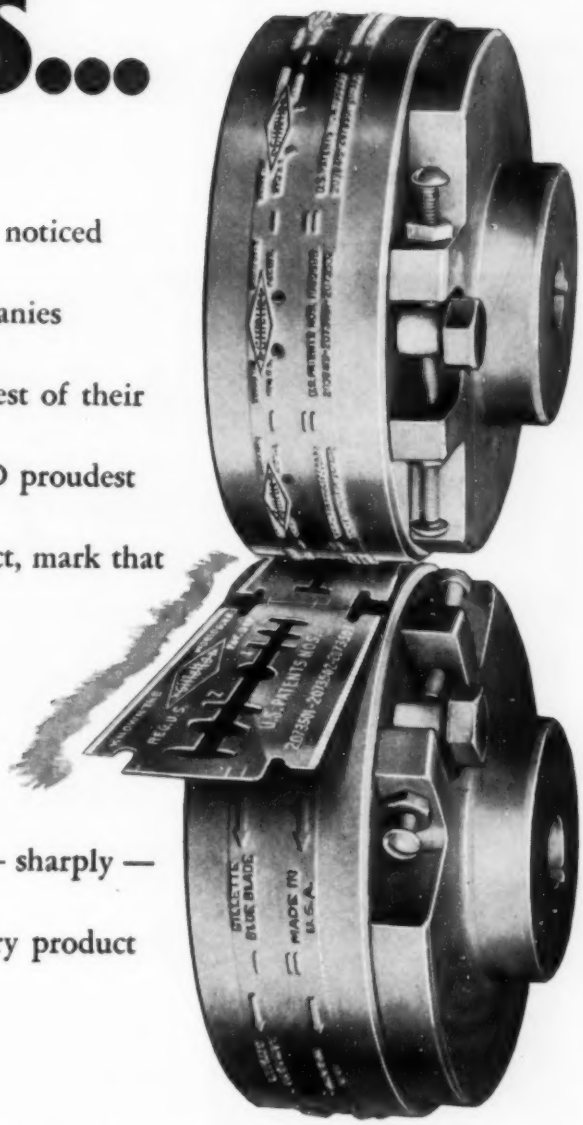
Hydraulic Oils

Selection and use of hydraulic oils for company's presses is covered in illustrated catalog stressing importance of using most suitable one for specific operations; includes discussions of factors affecting hydraulic performance and procedure which will assure suitable oil condition. A final section is devoted to operating notes. The Denison Engineering Co., Columbus, Ohio. **L-10-24**

Electrodes

Complete descriptive information as well as application and procedure data on Murex mild steel and low alloy arc welding electrodes covered in 30-page catalog aimed at helping select proper electrode for specific job; contains formulas for estimating welding costs, heat treating procedures, hardness conversion tables and other reference material. Metal & Thermit Corp., 100 E. 42nd St., New York 17, N. Y. **L-10-25**

MARKING DIES...



Have you ever noticed that the companies that are proudest of their name . . . AND proudest of their product, mark that name clearly — sharply — legibly on every product they make.

. . . Chances are, if it's a name you remember the marking die is made by Parker!

SEND FOR THIS 36 Page CATALOG "MARKING TOOLS" NOW!

THE PARKER STAMP WORKS, INC.
MARKING DIE & MACHINERY DIV.
FRANKLIN AVENUE • HARTFORD, CONNECTICUT
by Parker

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-149

Field Notes...

Name of the Industrial Furnace Manufacturers Association, Inc. has now been officially changed to Industrial Heating Equipment Association, Inc. According to Carl L. Ipsen, executive vice-president of the organization, the new name is not only more consistent with government terminology and classification, but also is more descriptive of the broadened membership which produces equipment to provide heat for many industrial processes.

If you want
a jig borer...
better see the
plus features
in the KNIGHT
No. 50
SPECIFICATIONS
• Spindle speeds, 16—40 to 2000 RPM
• Boring feeds, —infinitely variable, .0000"— .010"
• Vertical capacity—28"
• Table travel—longitudinal 28", cross 18"
• Table feeds—dial type, 16
• Table feeds—per minute, 5 16" to 20"
• Table rapid traverse—both directions, 100"
• Horsepower—7½
• Weight—8100 lbs.

The BIG ADVANTAGE of the Knight No. 50 lies not only in its ability to do precision boring and drilling, but in its versatility for performing a wide range of other difficult milling and machining operations without transferring the workpiece from one machine to another. Much of the layout work and preliminary drilling are eliminated, and the whole job is finished quicker on the No. 50.

In addition to making work transfers unnecessary, setup time is reduced by half or more—output is greatly increased—and fewer high-priced manhours are required on each job.

Exclusive on the No. 50 is the dial-controlled infinitely variable spindle feeds. Extra-long travel of the precision roller bearing-mounted one-piece spindle gives this versatile machine another plus feature. Extra-rugged and careful construction promise exceptional accuracy. Convenient quick action controls and full-vision work areas make operation simple and easy.

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ATTACH TO COMPANY LETTERHEAD

Send catalog on No. 50 and other Knight boring and milling machines.

Name.....

Title.....

☐ Send data on Knight's 20" and 42" Rotary Tables.

Send Coupon For Catalog

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-150

A technical periodical devoted exclusively to shock, vibration and noise isolation is being published by the Barry Corp. The new quarterly publication, called "Shock and Vibration Control Notes," is intended to provide a medium for the collection and propagation of ideas and information in the shock and vibration isolation fields.

V V V

Full line of its industrial motors and gearshift drives are being displayed in a traveling exhibition being taken by Lima Electric Motor Co. around the country in a fleet of station wagons. In this way, the company is endeavoring to give customers and prospects a view of regular production units firsthand. The displays are scheduled to travel through every state of the United States.

anniversaries

The Motch & Merryweather Machinery Co. recently celebrated its 50th anniversary. Originally, the founders, George E. Merryweather, Edwin R. Motch and Stanley Motch, established their firm in September, 1904, simply to serve as distributors of machine tools, representing machine tool builders in the Ohio and eastern Michigan area. Later this area expanded to include western Pennsylvania, Kentucky and part of Maryland, and branch offices were opened in Detroit, Pittsburgh, Cincinnati and Dayton.

Only four employees staffed the original office on Lakeside Ave. in Cleveland. By 1923 larger headquarters were necessary, so the move was accomplished to the Penton Bldg., still serving as company headquarters where the employee roster now lists 500 employees including office, sales and factory personnel.

Through the years the founders, all graduates of MIT and with apprenticeship experience in eastern metalworking plants, broadened the company's interests to manufacturing and machine tool rebuilding.

Now in its second generation, the company operates six divisions. Largest of these is the Machine Tool Distributor Div., which carries on its work from Cleveland and four branch offices. In an allied field, the firm operates the Cutting Tool Distributor Div. A plant on East 70th St. in Cleveland houses the Machinery Manufacturing Div., which builds a line of machine tools. A second plant, in

Euclid, houses the Used Machinery and Rebuilding Div. as well as the Cutting Tool Manufacturing Div. Finally only last year, the company established The Triple-M Products Div. in Gate Mills to produce and merchandise its own design multipurpose power garden tool.

Present officers carrying the founders' names are E. Franklin Motch, president and treasurer, and George E. Merryweather, vice-president and secretary.

V V V

Open-House marked official the anniversary date in September to culminate the 50th anniversary celebration of Pangborn Corp.

With the sale of his first sand blast machine in New York City, Thomas W. Pangborn, president, launched the company in the field of manufacture of blast cleaning and dust control equipment. The following year, his brother, John C. Pangborn, joined him in the work. By 1909 rapid growth of the organization necessitated establishment of a plant in Jersey City. However, these facilities were outgrown in only three years, and the business was moved to Hagerstown.

At present facilities include foundry, plate, sheet metal and machine shops, assembly plants, paint and woodworking shops.

V V V

On the occasion of its 25th anniversary, Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich. has published a 28-page booklet telling the story of company growth in the honing field. The booklet, available upon request from Micromatic Hone, contains pictures, illustrations and diagrams to effectively reveal the history and accomplishments of the firm.

expansions

With completion of new and larger plant facilities, H & N Manufacturing Corp. has organized a broadened corps of factory representatives in key industrial centers throughout the country in order to properly service users of the company's line of All-Flex swivel couplings.

V V V

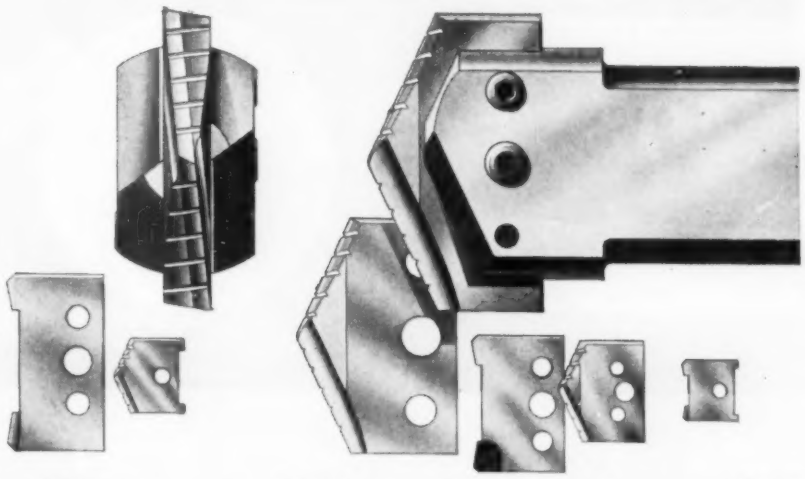
Northern Engineering Works has just completed an expansion program on its plant providing facilities for building larger and heavier overhead cranes.

An $800,000 expansion and modernization program has been completed by Empire Steel Castings, Inc. in order to increase casting capacity of the plant. The program has doubled plant area and tripled production capacity. The program not only included extension of plant space and installation of new equipment, but also the rearrangement of facilities for melting, molding, coremaking, cleaning, heat-treatment and inspection resulting in straightline production flow and more competent handling.

Work is under way on the $300,000 addition to Enamelstrip Corp. which will more than double the firm's working force. This represents a major step in the firm's recently launched million dollar expansion plan.

V V V

Move of the R. & S. Tool Co. to new and larger quarters has been completed. The new building, located at 13100 Enterprise Ave., Cleveland 11, Ohio, offers the greater space and additional equipment which will enable

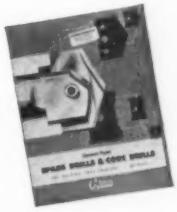


Drill Large Holes from the Solid with Interchangeable Spade Drills

Made in 256 cutter sizes, 1 to 5 inch diameter, in steps of 1/64, Conner type Spade Drills drill the required diameter in one operation, need no retracting to clear them of chips. Only eight sizes of holders are needed to handle all cutter sizes.

For general purpose work and in the Tool Room, use the cutter and holder assembly shown above. It is a rugged tool of great rigidity, recommended for large holes of medium depth.

For Production Drilling (for repetitive work), and for the somewhat deeper holes, use Conner type Oil Hole Holders designed for easy coolant flow and fast chip expulsion.



Send for Catalog and Price List

For Boring: Core Drill Cutters, for semi-finishing of cored and drilled holes, are made in the same 256 sizes, to fit the same spade drill holders.

The Gairing Tool Company is now the exclusive manufacturer of the Spade and Core Drills, both standard and special, formerly made by the Conner Tool & Cutter Company.

In Canada: A. C. Wickman (Canada) Ltd., Queensway, Toronto 14

The GAIRING Tool Company

21223 Hoover Road, Detroit 32, Michigan

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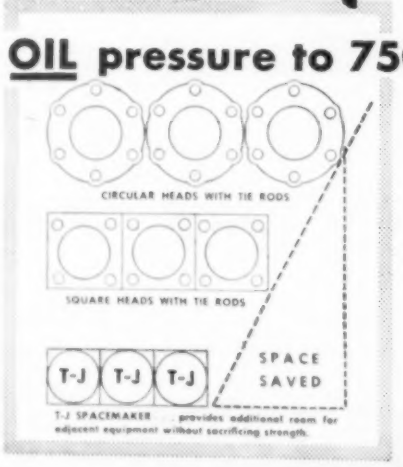
T-J
Spacemaker
CYLINDERS

OIL pressure to 750—AIR to 200 P.S.I.



Now the sensational new T-J Spacemaker sets the pace in compact cylinder design and efficient performance!

New "Self-Aligning" adjustable oil cushion means faster acceleration and better cushion than ever before . . . New T-J Super Cushion Flexible Seals for air insure positive cushion with automatic valve action for fast return stroke.

More plus features include—heavy wall, precision honed, hard chrome plated, seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, high-tensile, *hard chrome plated piston rod.* Write for bulletin SM-454-2. The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
RIVETORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-152

the firm to accommodate short production runs of special precision machining and grinding. According to the company, this new program will not interfere with regular production in any way.

V V V

Latrobe Steel Co. has announced completion of its new large warehouse in the Cleveland area. Location of the warehouse, devoted exclusively to tool and die steels, is at 5572 Brecksville Rd., Independence, Ohio.

V V V

Dedication of a new manufacturing plant and office was celebrated recently by Buckeye Tools Corp. The 25,000 sq. ft plant incorporates the latest ideas for functional convenience and operating efficiency.

purchases

Completion of its merger plans were effected between Olin Industries, Inc. and Mathieson Chemical Corp. on August 31 to form Olin Mathieson Chemical Corp. Stock in the new firm was traded on the stock exchanges beginning on September 1.

V V V

Manufacture of products formerly made by Newark Gear, Inc., now has been taken over by Potter & Johnston Co., subsidiary of Pratt & Whitney, Div. of Niles-Bement-Pond Co. These products include gear hobbing, cutting, testing and cutter grinding machines and their attachments. Sales and service for the Newark Gear machines will be handled by the Pratt & Whitney Sales Div. through its main and branch offices.

V V V

Entire line of production equipment, applicable patents and pertinent effects for extruding rods and tubes of various man-created materials for molding heavy gage sheets of Polyethylene and these materials, have been sold by Plax Corp. to Westlake Plastics Co. The transaction includes a large stock of finished products created in anticipation of temporary shut-down of production. It also covers patents controlling the Lubo-Film process for extruding rods and tubes and the Liquo-Temp process for annealing all products.

Primary reason for the Plax management's sale of these properties was to

perm[illegible] concentration and to provide larg[illegible] space and permit concentration on [illegible] company's "squeeze-bottle" and extr[illegible]ed film and oriented sheet business.

E[illegible]ipment for production was transferr[illegible] from the Plax location in Stonington, Conn. to the purchasing firm's home area in Lenni Mills, Pa.

V V V

Assets of the Hydraulic Press Mfg. Co. have been purchased for approximately $4,300,000 pending approval of H-P-M stockholders. According to announcement, the purchasing organization is headed by Frederick W. Richmond of New York. This is the same group which recently agreed to buy the assets of Follansbee Steel Corp.

new facilities

A plant for the manufacture of welding electrodes and brazing rods has been opened in Montevallo, Ala., by Westinghouse Electric Corp. The facility incorporates modern production techniques, latest quality control methods, good plant layout. The plant, where approximately 100 persons will be employed, will consume more than two million pounds of hot-rolled wire per month in the manufacture of welding electrodes. This is the third plant to be established in Alabama by Westinghouse in the past two years.

V V V

Ultra modern laboratory facilities have been opened by Carboloy Dept. of General Electric Co. for measuring and analyzing magnetic materials. Here engineers are able to check designs, measure performance and efficiency of equipment in which the products are used, establish standards, calibrate precision magnetic assemblies and evaluate new magnetic materials.

V V V

Establishment of a New England regional office at 35 Colony St., Meriden, Conn. has been announced by Detrex Corp. The new office, under the managership of A. D. Chabot, will serve Vermont, Maine, New Hampshire, Massachusetts, Connecticut and Rhode Island.

V V V

Clearing Machine Corp. has opened a direct factory office at 5 St. Paul St., Rochester 4, N.Y. to serve the upper and western parts of the state. Robert J. Falsey has been put in charge of the new office.

SPECIFY ADAMAS PREMIUM GRADE 434

for your toughest steel roughing operations including interrupted cuts

- HIGH SHOCK RESISTANCE
- HIGH WEAR RESISTANCE
- HIGH HEAT RESISTANCE
- HIGH DENSITY

Developed especially for removal of large amounts of metal—with minimum feed .015 and maximum feed dependent only on available horsepower—ADAMAS PREMIUM GRADE 434 is outperforming all other carbide grades in hundreds of plants throughout the country.

Plant after plant reports large savings in carbide costs resulting from up to 50% increase in tool life. Next time specify ADAMAS PREMIUM GRADE 434 and watch your production go up and your costs go down.

"First with Carbide That Lasts!"

ADAMAS TUNGSTEN CARBIDE®

ADAMAS CARBIDE CORPORATION, KENILWORTH, NEW JERSEY

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Men at Work . . .

Vincent Ayres has been made chief engineer and **G. D. Line** assistant chief engineer for the Eaton Manufacturing Co.'s Saginaw Div. Mr. Ayres was previously assistant chief engineer of the Valve and Saginaw Divs., while Mr. Line formerly was customer contact engineer for those divisions.

Charles E. Schell has been made assistant to the plant manager of John Volkert Metal Stampings, Inc. Mr. Schell has been associated with Sylvania Electric Products, Inc. for the past 25 years, serving most recently as plant manager of Sylvania's Parts Div.

At its recent annual convention, the American Electroplaters' Society elected **Ralph A. Schaefer** to the office of president. Dr. Schaefer is vice-president of the Clevite-Brush Development Co., subsidiary of Cleveland Graphite Bronze Co.

Follansbee Steel Corp. has announced appointment of **Edwin H. Engel** to the position of chief of quality control. For the past five years, Mr. Engel has been chief metallurgical engineer and assistant to the general superintendent of Compania de Acero del Pacifico in Chile.

Two new central research and development departments have been established by Rockwell Manufacturing Co. To fill the key posts in these departments two former chief engineers of Rockwell divisions have been promoted. **Howard J. Evans,** who has been chief engineer of the Pittsburgh Equitable Meter Div., is now chief engineer and manager of the Central Gas Products Research and Development Dept., while **H. A. Altorfer,** former chief engineer of the Nordstrom Valve Div., has been made chief engineer and manager of the Central Valve Research and Development Dept.

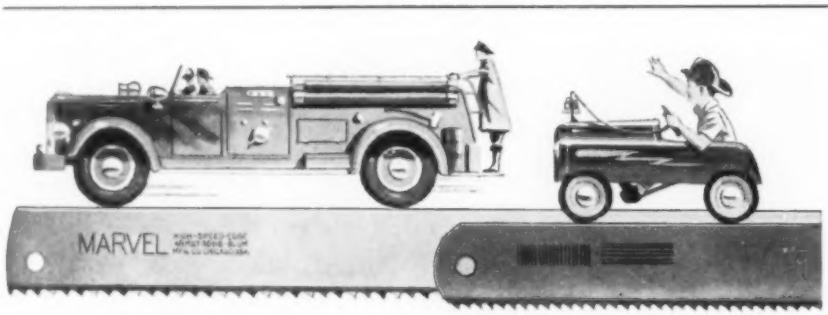
I. Wendell Hamm has been made director of manufacturing for The Carborundum Co. Mr. Hamm, who joined the firm in 1934, served successively as an industrial engineer, a management engineer and a trouble shooter.

Gisholt Machine Co. has announced the election of **Howell W. Murray** to the company's board of directors. Mr. Murray also is vice-president and a director of A. G. Becker & Co., and a director of the Gardner-Denver Co. and of the Parker Pen Co.

At this same board meeting, announcement was made of the retirement of **George E. Gernon** as an active member of the board. In acknowledgement of his many years' service, he was appointed an honorary member of the board. He has been secretary of the firm for the past 49 years and continues in that capacity.

According to recent announcement, **L. C. Schweitzer** has been made assistant general manager of the Tocco Div. of The Ohio Crankshaft Co. He formerly was the division's Chicago district manager.

Two new administrative officers have been named at Rem-Cru Titanium, Inc. **Walter E. Gregg,** now vice-president and assistant general manager, will supervise operations and coordinate major departments of the company. **Walter L. Finlay,** as vice-president and manager of research will be responsible for the company's metallurgical research and developmental activities.



. . . *but*

Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate—without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

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Archie **F. Wilson** has been named director of manufacturing of Hydraulic Press Mfg. Co. Previously he was manager of plant operations at Mather Stock Car Co. where he supervised operations of the firm's eight plants.

Carl W. Larrick has been appointed works manager of the Morris Machine Tool Co. Mr. Larrick, who has been associated with this company for the past four years, previously held the post of production control manager.

Joseph E. Smith, Jr. is manager of the Gage and Spindle Div. of Bryant Chucking Grinder Co. His responsibilities will include coordination of sales, engineering and manufacturing. He formerly was chief process engineer.

James W. Dickey is new president of the Ohio Hoist & Mfg. Co. and of Alcaloy Inc. He formerly was executive vice-president of the companies as well as of ten round chain manufacturing firms recently acquired by Republic Steel.

Election of **Conde Hamlin** to the position of vice-president in charge of sales and a director of the company has been announced by DeWalt Inc., subsidiary of American Machine & Foundry Co. Mr. Hamlin has been DeWalt's general sales manager for the past two years.

Walter E. Jones, metallurgical development engineer at the Thomson Laboratory of General Electric Co., has been made manager of vacuum melted products engineering at Carboloy Dept. of G.E.

Several changes in its engineering organization have been announced by The Fellows Gear Shaper Co. **Bernard L. Ward,** formerly chief of machine design is now assistant chief engineer; **Henry G. Stone** was made chief of tool design; and **J. L. Williamson** was named chief of research.

Wilson L. Young is new chief service engineer for Colonial Broach Co. after having served as assistant service manager for the company.

P. L. Dafoe, who is on leave from his responsibilities as vice-president and general sales manager of the Acme Steel Products Div., has been named to head the firm's new Dexion Div. **Lewis R. Miller** was made assistant manager of the division. Mr. Miller was previously product manager of the household utilities department of Ingersoll Products Div. of Borg Warner Co.

Appointment of **William C. Decker** as a director has been made public by Allied Products Corp. Mr. Decker is president and a director of both Corning Glass Works and Corning Glass Works of Canada, Ltd.

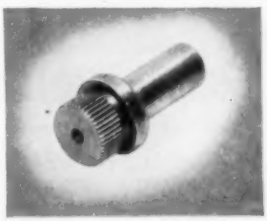
Why wait?
CUT YOUR COSTS NOW!

let the leading manufacturer of broaching equipment show you how to lower your break-even costs.

Unified Broaching
COLONIAL

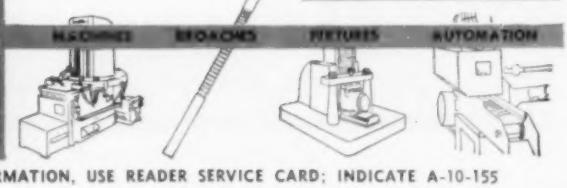
TEN TIMES FASTER than previous methods—broaching top and bottom radii on these automatic transmission reverse band anchors is helping one manufacturer lower the break-even costs. The broached part is not only more accurate, but thousands of the anchors are being machined between broach sharpenings.

THIRTY TIMES FASTER than milling—broaching the intricate shapes of these copper breaker points has meant lower costs. Seven pieces are broached at a time using only two sets of Colonial broaches. 75,000 breaker points are completed before it is necessary to sharpen the broaches.



TWENTY TIMES FASTER than other methods—serrations on this shaft are cut with a button broach in a single pass. Hundreds of other applications on file at Colonial attest to the tremendous cost-cutting potential of "Unified Broaching." Send us prints of your parts—we'll show you how to cut costs.

MACHINES BROACHES FIXTURES AUTOMATION



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Technical Shorts...

Ultrasensative Control Devices

Sensitivity to certain infrared rays which is 10,000 times as great as that of previous laboratory instruments is the outstanding quality of the detection device developed by Eastman Kodak Co. after a decade of research. Made of little slips of glass coated with lead sulfide, these tiny photoconductive cells are expected to provide basis for new devices for detecting over long distances warm objects without physical contact. Among the development's advantages are its simplicity, its adaptability to manufacture in any size or shape, and its sensitivity, not only to the invisible heat rays of near infrared, but to all colors of visible light on into the ultraviolet.

Most immediate foreseeable uses, aside from work as heat-detection devices, for the Ektron Detectors as they are identified, are in chemical plant applications and in switch applications. In the chemical plant, the cells could automatically monitor exact composition of fluids flowing through pipes and process vessels on the basis of the characteristic infrared color of various components. Very fine differences can be detected in this infrared color of chemicals. Water and gasoline, for example, both appear colorless to the eye, but are entirely different to an infrared detector.

In electrical switching applications, the Ektron Detector might well find applications in locations where mechanical switching devices are too bulky, or otherwise impractical. In such applications the detector might be used in conjunction with light beams, invisible to the naked eye, to eliminate a moving part.

Multiple detectors may be arranged in endless patterns. Engineers, for the sake of demonstration, showed 20 detectors, each about the size of a pinpoint, arranged on less than an inch of glass. These were intended to operate complex combinations of electrical circuits in response to projected patterns of light or heat radiation.

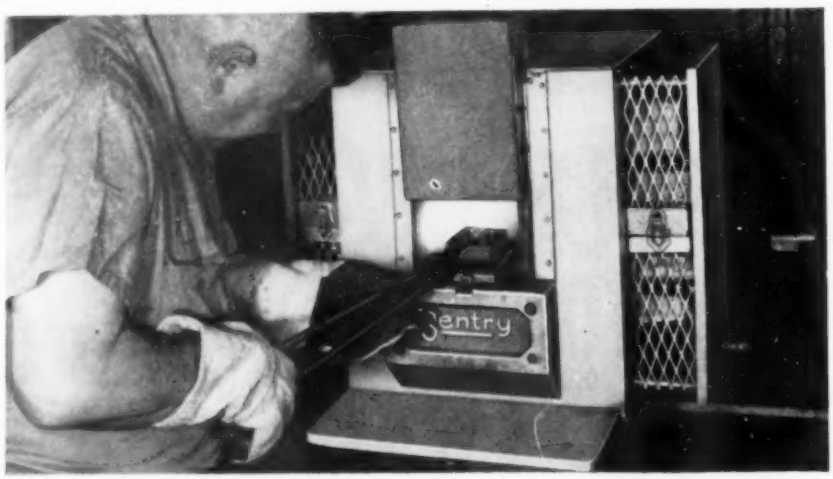
* * *

Standard Designations for Aluminum

The Aluminum Association has developed a new system of alloy designations for wrought aluminum and aluminum alloys which were officially approved by that organization this past summer. Identified as "The Aluminum Association Alloy Designation System for Wrought Aluminum," the system will become effective October 1. These designations, which consist of four digit numbers, are expected to meet all of industry's present and future needs in this field. The first digit of each designation indicates the general group to which a given alloy belongs; the second digit indicates any modifications of the original alloy or impurity limits; the final two digits identify the alloy or indicate the aluminum purity.

The designations give an identifying number with the intial digit of 1 to aluminum of 99-percent minimum and greater. Alloying elements of aluminum are indicated by an initial digit of 2 for copper; 3 for manganese; 4 for silicon; 5 for magnesium; 6 for magnesium and silicon; 7 for zinc; and 8 for other elements.

Early in development work on aluminum, identification was a simple matter



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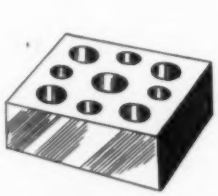
is a MUST
at LUX CLOCK

At The Lux Clock Mfg. Co. of Waterbury, Conn. an average of 165 special intricate cutting tools, blanking dies and punches are heat treated daily. Quality, with freedom from scale or decarburization, is a "must" to avoid costly tool spoilage.

By using their Sentry Furnace and The Sentry Diamond Block Atmosphere, Lux say they are assured of consistent quality hardening on *all* their tools and dies made from high speed or air hardening steels.



A high-carbon, high-chrome blanking die—typical of items heat-treated at Lux.

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because there were few alloys and few grades of purity were available. Later, a numerical system came into use which was often suitable. As alloys grew in number and type, the system necessarily was broadened to permit classifications to be incorporated; S, for example, identified the sheet, the only wrought aluminum product made on a large scale. Later wire and other wrought products came into being but the S designations were still retained. As the industry expanded, new producers entering the field formulated their special designations, while still different governmental specifications offered more confusion.

To help avoid confusion in transition from previously used designations to the new system, many old numbers are retained as the last two digits of new identifications. For example, alloy 3S is now 3003, 24S is 2024, and 61S is 6061.

The Aluminum Association system, by providing a uniform set of designations, undoubtedly will be welcomed by fabricators as well as users who, if adopted on an industry-wide scale, will be able to order by the same alloy number regardless of supplier.

* * *

Flexible Ceramic Coating

DEVELOPMENT of a process which permits application of flexible ceramic coatings to a wide variety of materials has been revealed by Armour Research Foundation of Illinois Institute of Technology. These coatings, identified as "solution ceramics," differ from conventional coatings such as porcelain enamel in that they are not brittle and can be applied to almost any clean surface at a few hundred degrees Fahr. Neither expensive equipment nor protected heating are a requirement for proper application.

Solution ceramics, which are so called because they are applied from chemical solutions and contain no adhesive or binding agent, offer several features. Temperatures required by the process is much lower than that required for porcelain enamel. Accurate control of the coating thickness is possible whether the deposit desired is only a few millionths of an inch or as thick as 0.01.

Highly resistant to heat, the more refractory coatings can be used to protect metal against such elements as molten metal or slag.

Since the new coatings are less hard than ordinary ceramic materials and can be scratched with a sharp blade,

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Every Metal Component of the Eversharp Hydro-Magic Razor!

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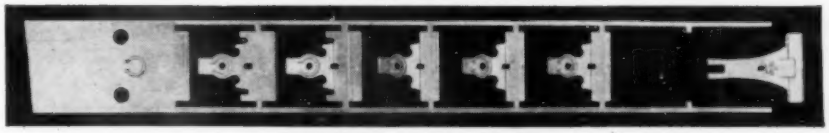
Eversharp-Schick specified dies to mass produce a razor of superior quality . . . flawless operation . . . competitive price. Working against a tight schedule, B. Jahn evolved a series of progressive dies that turned out each individual metal component used in the razor! Every close tolerance was faithfully met — all specifications of die performance were adhered to — every requirement of product quality and accuracy was engineered and built into the dies by B. Jahn. To guarantee customer satisfaction, components were submitted to Eversharp-Schick for actual assembly line use before the dies were certified "PRODUCTION PROVED" and shipped!

12 STATION DIE RIBBON



7 STATION DIE RIBBON

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Amazingly simple EASY-FLO or SIL-FOS brazing pays big dividends

Photo and data courtesy of FLAIR MFG. CORP., Brooklyn, N.Y.

EASY DOES IT—An endless chain runs at predetermined speed between a pair of city gas-air burners. Operator places bodies in angle-iron carriers, takes spuds with preplaced EASY-FLO rings, dips them in Handy Flux and sets them in bodies. The rest is automatic. Using only one row of carriers, output is 18 a minute.

Expert "Know-how" at your service

In cooperation with the manufacturer we worked out the valve brazing set-up – and we're ready to work with you. As originators of EASY-FLO and SIL-FOS low-temperature silver brazing alloys, we offer you the benefit of the maximum technical knowledge about the process and practical experience in its application available anywhere today. There's no obligation for this assistance. Just phone or write when you would like a field service engineer to call.

It's a safe bet you can get a better product at much lower cost on several of your metal parts by designing them for EASY-FLO or SIL-FOS silver brazed construction—supplemented by a simple production set-up that makes the brazing so easy—*anybody can do it!*

Here's an example—a radiator valve. It is made of a simple drawn body and a screw machine part, brazed with EASY-FLO. And the joining is done on a set-up that "automation-izes" the actual brazing. The net results—a smaller, trimmer valve—and a favorably low production cost.

FOR THE FACTS IN PRINT...
Write for Bulletin 20. It gives them all plus a lot of useful information about fast, low-cost production brazing.

At the METAL SHOW—Chicago—Nov. 1-5
SEE the comprehensive exhibit of low-temperature silver brazing jobs from many industries. Our engineers with the know-how will be there ready and waiting to chat with you about your metal joining. BOOTH 342

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metal can be stamped after coating.

Most of the solution ceramics are adherent to the surface of the underlying material to a degree that allows other coatings to be anchored to them.

The process will be made available to industrial firms through license agreements which allow them to use Foundation patents.

* * *

Study Atom for Processing Work

CHEMICAL AND METALLURGICAL processing problems associated with nuclear power systems are scheduled for study by the Vitro Corp. of America with the approval by the Atomic Energy Commission. The company-financed investigation will be the first undertaken in this field under the Industrial Participation Program for development of competitive nuclear power. Among the specific aspects to be dealt with include work on preparation of fuel, removal of fission product poisons, primary separation of material discharged from the reactor, recovery and reworking of unspent fuel, recovery and decontamination of fissionable material produced in reactors and radioactive waste disposal.

Available industrial power studies and the AEC's reactor development program will also be surveyed by Vitro to determine trends in processing requirements, the most probable lines of development and the most promising techniques. After consideration of these points, one or more processing concepts will be selected for engineering analysis and preliminary design studies. The company will then estimate processing costs as related to the over-all nuclear power economics.

The agreement covers one year, after which the company will report its findings and recommendations for further development work to AEC.

* * *

Automatic Hand for Remote Work

OPERATION OF remotely situated control of reciprocating aircraft or automotive engines while test work is going on has been simplified as a result of a robot hand developed by Minneapolis - Honeywell Regulator Co. The automatic hand or "electronic remote positioning system" functions more delicately than a human hand at distances ranging from 12 inches to 1000 ft. It is said to be 100 times more responsive than hydraulic systems previously used for this work.

technical digests

Deep Drawing Titanium

Performed in One Operation

by Ralph Gillespie

Brooks & Perkins, Inc.
Detroit, Mich.

SINCE TITANIUM is structurally similar to magnesium, theoretically, techniques for deep drawing and forming the two metals should be much the same. Based on this premise and a vast fund of experience in working magnesium, Brooks & Perkins undertook a research and development program to explore titanium forming techniques. The work was carried out independently without government sponsorship.

A variety of deep drawn parts, *Fig.* 1, have been produced in single operation hot draws, using several different titanium alloys. Previously, it had been assumed by titanium fabricators that multiple draws were necessary, with intermediate anneals. This new technique opens up interesting possibilities in the design and use of titanium. Costs of fabrication of many parts can be reduced by this method.

Not only are the costs of additional operations eliminated in this process, but tooling costs are greatly reduced, as only one set of dies is necessary. Final limits on the process have yet to be discovered. For instance, the part shown in *Fig.* 2 was hot drawn in a single operation to the depth of 5 inches and indications were that it could have been drawn even deeper. The corner radius is ¼ inch. No difficulty was encountered in the draw which is unusually deep for a 3-inch diameter cylinder. Results on this job indicate that in some cases titanium may be even easier to hot draw than magnesium. It was discovered in other cases that smaller radii can be held at the bottom of a box draw than at the side corners. Radii at junction of side with bottom can be held to ¼ inch or even 3/16 inch without difficulty.

Another development is the use of the Guerin process to form titanium parts. Possibilities of this process were explored because tooling costs are relatively low for rubber forming. Also, the process has been found quite useful in the aircraft industry for forming small quantities of parts where bending of contour of small workpieces is required. While aluminum parts are normally cold formed in this method, titanium, like magnesium, was found to require heating for best results. The developed blank and the hydro-formed die are both heated. Titanium parts can then be rubber formed without difficulty, using the same techniques as for magnesium alloy, *Fig.* 3.

In evaluating depth of draws and radii possible, it is important to keep in mind that parts illustrated here were drawn without difficulty on the first attempts. Had the dies been made for draws of greater depth and sharper radii, more severe draws could have been made. It is impossible at this time to predict the ultimate in drawability.

Virtually anything that can be drawn in magnesium in one operation can be drawn in A-55 and A-70 alloys, it seems. Although C-110M is more difficult to draw, progress is being made and the company tool engineers are confident that through close control of conditions, techniques will soon be perfected for drawing this alloy to equivalent depth in one operation, also.

These tests dispel some of the mystery surrounding the press working of ti-

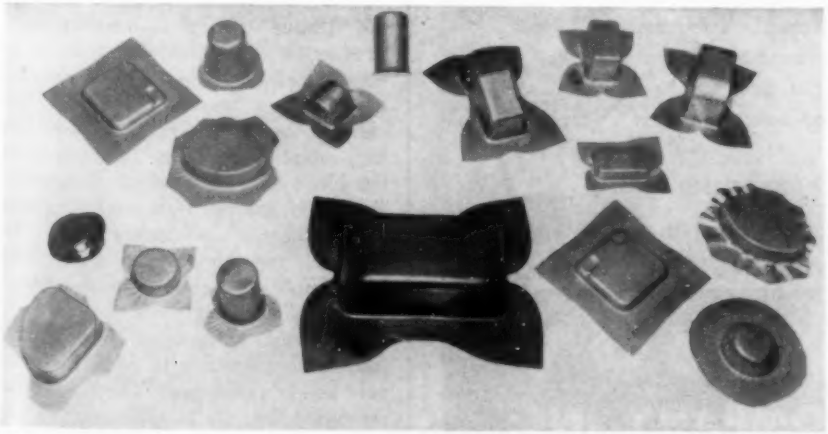


Fig. 1. Deep draws made in one operation with RC-55, RC-70 and RC-130A titanium sheet. Hydraulic presses ranging from 75-700 tons capacity were used.

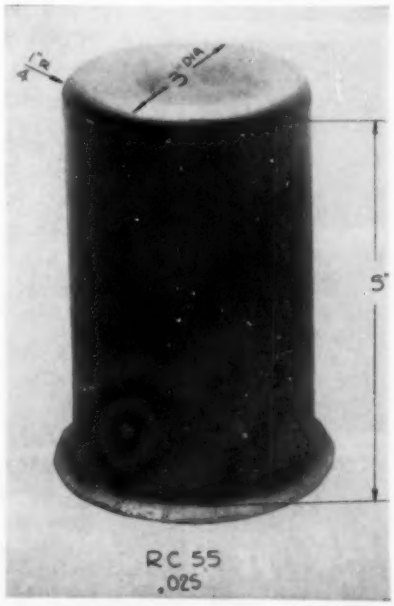
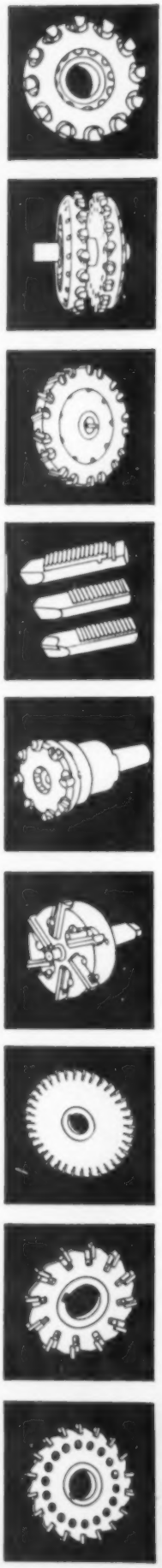


Fig. 2. Cylinder hot drawn with one stroke of the press shows potentialities.



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5 Extra rugged blade and body design assures maximum results on modern, high-speed millers.

6 H. S. S., alloy and carbide-tipped blades are available promptly from stock.

7 Lovejoy design is tops for blade interchangeability in practically all cutter styles and sizes.

8 Lovejoy has had 35 years of experience in designing and manufacturing standard and special cutters for the country's leading manufacturers—our background can help you get best results from your milling operations.

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tanium. They point to the astounding conclusion that titanium, like magnesium, can be drawn more severely in one operation than can more common metals such as aluminum, steel and brass.

With the combination of advantages

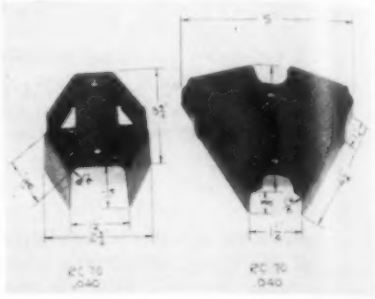

Fig. 3. Typical parts rubber formed (Guerin process). Blanks were heated.

of high strength, light weight and corrosion resistance of titanium, fabricating and production methods have the big block barring extensive use. Now, with heat drawing possible in one operation—an economy factor that even steel and aluminum lack—progress as one of the most useful materials will undoubtedly be accelerated.

From a report published in the July '54 Rem Cru Titanium Review.

▼ ▼ ▼

Automation for Small Plants

by Julius Y. Kaplan

Head Servo Section
Arma Corp.
Garden City, N. Y.

A large segment of metalworking in the United States is small-quantity production. Such production cannot be economically handled on conventional automatic or manually operated machine tools. Techniques are available for adapting present equipment to flexible automatic control from tape. By this means the high machining rate of automatic machinery may be achieved, together with relatively fast and simple change-over to the manufacture of different parts.

Techniques of automatic control and information handling to do this job are now highly developed. The equipment required for its implementation is largely commercially available.

This approach is shown to be prac-

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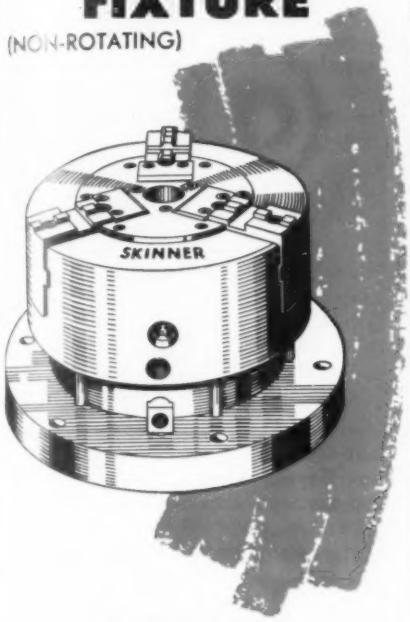

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Close coupling makes this Skinner Power Chuck Fixture the lowest, most compact unit of its type! Air-operated, it can be used on drilling, milling and transfer machines, and for assembly operations.

Special wedge action provides tremendous gripping power. Self-centering, self-locking. Available in 8", 10" or 12" dia., with 2 or 3 jaws. Operable with either a Skinner hand valve or a 4-way solenoid or foot valve. ⅜" pipe connections. Maximum air pressure: 100 lbs.

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tical, and is exemplified by cases where manually operated machines were upgraded to versatile automatic operation.

Through modern techniques of feedback control and information handling, present machine tools can be practically adapted for versatile automatic control from a tape, *Fig.* 1. Normally, a new part requires a change in tape,

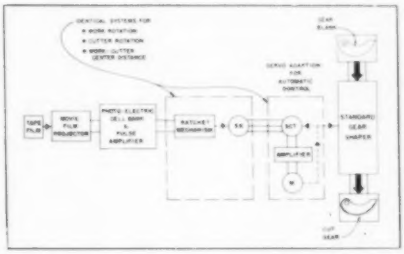

Fig. 1. Noncircular gear-cutting process set up with available machines.

and production need normally wait only for the time required to change.

Such machines can show large increases in productivity in the order of 200 to 400 percent for small- and medium-quantity production. Mass-production machines, so adapted, would be able to effect fast delivery of small-quantity orders. Tape control makes possible, frequently, the accomplishment of complicated machining not otherwise practical. The cost per machine for flexible automation, or fleximation, can be quite reasonable, given a modest number of machines handling the same character of production. Machines should be fleximated to the extent that is profitable for the kind and quantity of production handled.

A general reluctance to discard existing machine tools points up a potentially large market for adapting machine tools already on hand. The widespread experience gained in applying flexible controls to machine tools should accelerate the evolution of more improved future automation and, ultimately, the automatic factory.

From a paper given at the 1954 Automatic Production Symposium sponsored by Stanford Research Institute & USAF, San Francisco.

▼ ▼ ▼

Brazing Molybdenum for High-Temperature Service

By M. I. Jacobson and D. C. Martin

Battelle Memorial Institute

Brazing methods that were investigated included vacuum brazing in an Inconel retort, oxyacetylene torch braz-

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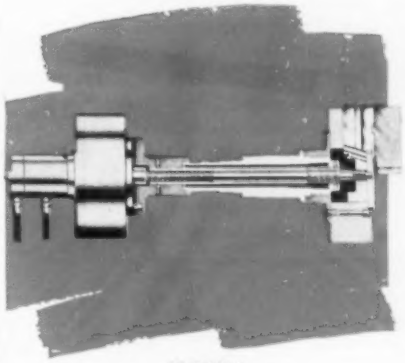

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Maximum production speed for your small lathes TOO!

This Skinner "Junior" unit can be adapted to almost any small lathe with 1" to 1⅜" hole through the spindle. It is light in weight, precisely balanced to minimize spindle bearing and braking loads, and provides extreme repetitive accuracy on internal and external work.

The Skinner 8" self-centering power chuck has gripping capacity from ¼" to 6". Its ¼" jaw travel exceeds the capacity of any collet, and is particularly valuable on production work where rough or finished holding diameters may vary beyond a single collet's ability to grip.

The Skinner "Junior" unit is complete. It contains chuck, 6" aluminum air cylinder, adapters, draw bar, etc.

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On every application, every material — there's a specific Nelco end mill in stock designed to do the job — and do it better, quicker and at less cost than it's ever been done before! Here are the facts to prove this astonishing statement:

Specific rake angles are engineered for each individual tool to guarantee maximum performance and life!

Selection of the hardest practical grade of carbide for each end mill makes available from stock the most efficient tool to do your specific job!

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Eliminate "jack-of-all-trade" tools! Select a Nelco End Mill from stock, engineered to save hours and make dollars for you! Call the Nelco distributor in your vicinity and send today for your free copy of the new 48-page Nelco catalog.

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ing with a flux, tungsten-arc torch brazing in a helium atmosphere, induction brazing in vacuum, and induction brazing in argon. Sixteen high-temperature brazing alloys that had melting points of 1800 F or higher were studied.

The major factors that were determined were the ability of the alloy to braze molybdenum, the brazing techniques required to obtain good joints, and the properties of brazed joints in commercial molybdenum sheet at room temperature and at a temperature of 1800 F.

Induction brazing in an argon atmosphere was the most satisfactory brazing method from the standpoint of braze quality and practicability. Room-temperature strengths of brazed joints were generally low because of recrystallization of the base metal and because of the notch effects inherent in the joints.

Short-time tension tests at 1800 F of joints induction brazed in argon showed that the best cobalt-base brazing alloy was Haynes Alloy 25 which produced a braze with shear strength of 14,250 psi.

The best noncobalt-base brazing alloy was Inconel which produced a braze with a shear strength of 18,800 psi. The 100-hour shear strength at 1800 F of joints induction brazed with Inconel was found to be 5000 psi, while the 100-hour shear strength of joints induction brazed with Haynes Alloy 25 was found to be 4500 psi.

From a paper presented at the 2nd annual welding show and 1954 spring meeting of American Welding Society.

▼ ▼ ▼

Applying Machines to European Production

By N. C. Rubin, Vice Pres.
The Yoder Co.
Cleveland, Ohio

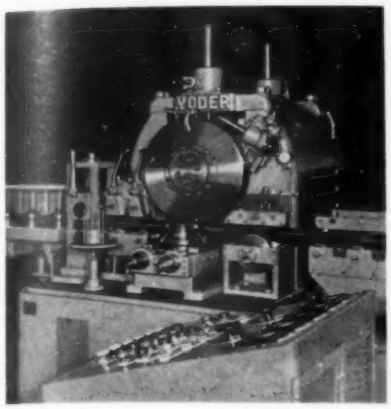
The adaption of American machinery to European requirements is of tremendous importance. It involves not just the maintenance of a vast market but the recovery of a rapidly diminishing market.

However, because of certain design innovations and "know-how" built into our machines, many Europeans prefer American equipment provided it incorporates certain features.

To sell machinery of most any type in

Europe, it must produce at a fair rate of speed and, also, it must be possible to retool in a matter of minutes. Production quantities for the most part do not begin to compare with our figures and individual runs will be far lower.

For example, a complete set of rolls can be changed in an electric weld tube mill, such as pictured, in about three



to four hours. If the mill is then in production for about 80 hours, the retooling time amounts to 4 percent of production time. It is quite normal in Europe to run a tube mill about eight to 10 hours on one size of tube before changing rolls, which means 35 to 40 percent of production time is used for retooling. Obviously, a solution must be found if this is to be an attractive investment for the customer.

Simplicity in design is another tremendously important point in supplying machinery to Europe. It is much more difficult for a European to procure repair parts.

It is important to minimize the use of cylinders, solenoids and the like to obtain reciprocating or rocking motions. In many instances there is a decided preference to cams or screws because they can be maintained in any machine shop.

If it is necessary to use an extensive electrical control system, it should be as simple or accessible as possible as it is quite likely that the power supply will be changed in a short time. Electrical frequencies that have been in use many years, such as 25, 42 and 50 cycles, are due to be changed to 60 cycles in the near future.

In many areas, water supply is extremely short so that only a minimum should be used and, where possible, it should be recirculated and used again.

Europeans generally are more willing to accept aggressiveness or innovations in design than is usually the case with American firms.

Probably the most important point in considering the designs of German or European built machines is that, right or wrong, the customer will compare the American machine to these long established standards of weight and proportion. Any radical departure from these old standards will not be readily received unless it can demonstrate a satisfactory performance over a reasonable period of time.

All of Europe is keenly interested in new American design and development. Many of those people are anxious to be the first in their country to practice a new American process and to install a completely new type machine.

From a paper given at the 1954 Machine Design Conference of the Cleveland Engineering Society.

▼ ▼ ▼

Reducing Tool Costs by Statistical Control

by W. H. Seacord
F. L. Helmel

Mechanical Engineering Div.
International Harvester Co.
Chicago, Ill.

Because of the marked success of the statistical quality control program in production operations, it was decided to apply statistical methods to the perishable tool program. In studying the benefits to be derived from such a program, it was felt a reduced tool cost per piece part could be attained.

One of the first decisions made was the selection of a unit of measurement. It was decided that stock removed per thousandth of cutting tool used would be considered a standard. However, it

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3 Bronze plated and steel bushings strain relieved to hold their size and shape indefinitely.
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5 Pre-finished hole to assure full length concentricity, better fit and longer life.
6 Honed hole to provide proper surface condition for precision fit and best lubrication.
7 Bearing surface extends full length of body . . . increases bearing area up to 25% . . . assures better alignment.
8 Figure eight oil groove for complete lubrication over entire area. Also, hydraulic action self-centers guide pin in the bushing.
9 Alemite fitting for easy, positive lubrication.
10 Specially designed retainers to securely hold the bushing in exact position . . . eliminates unknown holding strength of press fit.
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would be difficult to compare the tool life of a gear hob with that of a milling cutter, a slab broach or a drill. Also, the treatment and handling of various types of tools are different. A slightly different type of program for each of the various types of tools has been established.

Statistical control methods are applied to gear hobs, milling cutters, broaches and form tools. These programs will be expanded to other tools in the future. Gear hobs can be used as a typical example for a description of the control methods applied to this type of tools. These control methods can be used with certain modifications for all other types of tools. Control methods outlined are representative only; plants with varying physical and organizational setup have established control methods varying in minor details. The tool control center is used as the focal point of the statistical control program.

A hob is first identified by the manufacturer's serial number. Provision is then made on the hob for measuring the amount of tool life and the amount to be ground off in the resharpening operations. A flat with a 20-degree rake is ground on the back of the first full tooth, *Fig.* 1. Then by the use of button micrometers, *Fig.* 2, the thickness of the tooth is measured and recorded. A hob performance card, *Fig.* 3, showing the hob numbers, is attached to the hob. The new hob with the card attached now goes to the production tool crib to await its first job.

After all hob shifts have been used and the hob requires sharpening, the production operator returns the hob with its performance card or cards to the tool crib in exchange for a sharp hob. The dull tool with the card or cards are then sent to the hob control center for examination and posting of the information obtained.

The hob control center maintains a complete historical record of each hob.

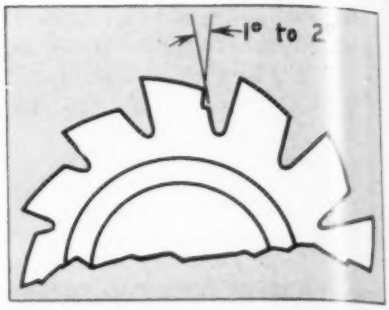
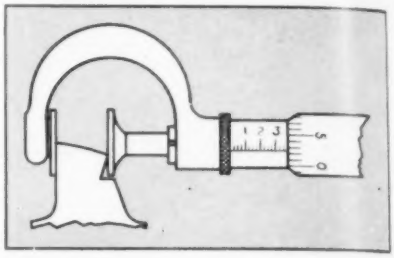


Fig. 1. Flat ground on hob to permit measuring thickness of tooth.

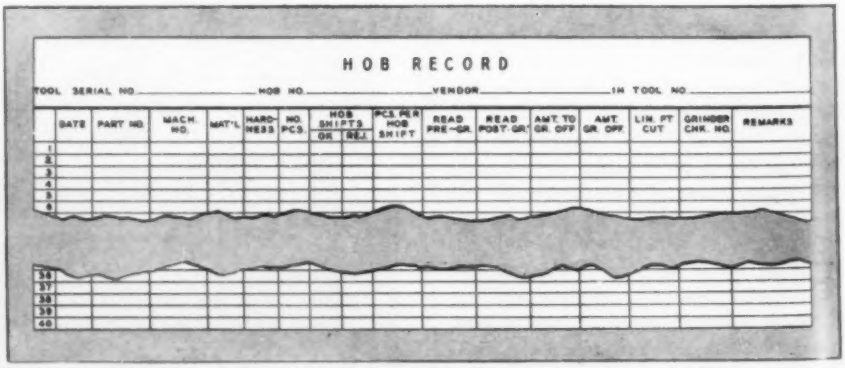
Fig. 2. Measurement of tooth thickness with button micrometer.



This is indicated on Hob Record Card, *Fig.* 4. This card contains no technical information regarding the hob other than its identity. Provisions have been made for the recording of complete information regarding the performance of the hob. That does not mean, however, that each column is always completely filled out. For example, the fifth column entitled "Hardness" is filled out only when an abnormal condition is experienced resulting in unfavorable performance of the hob.

The perishable tool engineer periodically reviews the information posted on this card looking for evidence of abnormally good or poor performance. Information regarding tool cost for a specific end product can also be obtained from this card.

When the dull hob with its performance card is returned to the control center from the production tool crib, the information recorded is posted on the Hob Record Card. The Hob Performance Card is then separated from the hob and filed.


HOB RECORD

TOOL SERIAL NO. _____ HOB NO. _____ VENDOR _____ IH TOOL NO. _____

	DATE	PART NO.	MACH. NO.	MAT'L	HARDNESS	NO. PCS.	HOB SHIFTS OR	HOB SHIFTS REJ.	PCS. PER HOB SHIFT	READ PRE-GR.	READ POST GR.	AMT. TO GR. OFF	AMT. GR. OFF	LIN. FT. CUT	GRINDER CHK. NO.	REMARKS
1																
2																
3																
4																
5																
6																
36																
37																
38																
39																
40																

Fig. 4. Blank used for historical record of tool throughout its life.

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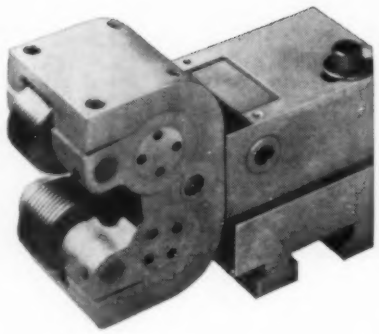

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In one plant it was found that hob life had been increased 30 percent by controlling the amount to be removed in sharpening. This also was found to be true on other perishable tools controlled.

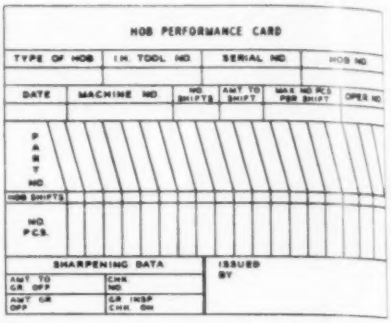

Fig. 3. Record card collects data on tool usage for one life cycle.

Plants also report that their tool research engineers have less trouble in finding and correcting out-of-line conditions, and they have had more time available to study and try out new and improved tooling methods.

From a paper (No. 216) presented at the 1954 SAE Annual Meeting.

▼ ▼ ▼

Structural Bonding Simplifies Aircraft Production

By George E. Holbaek and James L. Burridge
Structures Dept.
The Glenn L. Martin Co.
Baltimore, Md.

Aircraft structural engineers have long been intrigued by the possibility of eliminating the thousands of assembly operations required for typical airframe structure of many formed pieces joined by rivets and bolts, and of replacing these multiple operations with automatic operations employing simply temperature and pressure. It required the challenge presented by the guided missile, which calls for a more efficient structure in thin sections, high rates of production, lower costs and small easily expandable facilities, to advance this idea from a laboratory procedure to a production reality.

The goal has been reached in Air Force and Navy projects at The Glenn L. Martin Company through the use of adhesives to join metal skins to low density cores forming sandwich type structures. The use of both of these

adhesive applications in the construction of a single part has led to major savings of weight and to lower manufacturing time and cost.

The low density core is honeycomb, a material which is fabricated by joining corrugated aluminum foil with adhesive to form hexagonal cells. The same adhesive is used throughout. Applications have been developed for several projects, the most advanced of which is the B-61A Matador.

Adhesive Strength

An adhesive joint between core and face material will have adequate strength to stabilize aluminum faces against buckling up to the compression yield. Metal-to-metal joints will typically develop over 4,000 psi in the adhesive, when a standard ½-inch lap joint specimen of 0.064 sheet is tested. The load which a given shear joint will carry is a function, primarily, of the stress in the metal sheet as it enters the bonded joint, of the length of the lap, the eccentricity of the joint, the yield strength and modulus of elasticity of the adherents, and the modulus of rigidity of the adhesive.

The temperature range of the adhesive which complies with MIL-A-8331, gives values for ½-inch lap specimens, *Fig.* 1. It is to be noted that there is a

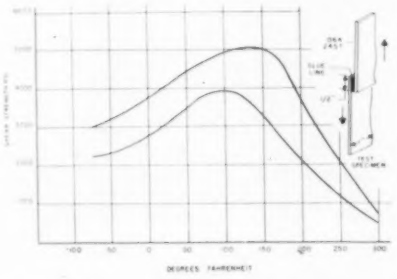

Fig. 1. Shear strength of FM-47 adhesive with minimum cure at 300 F.

certain area beneath the psi curve. With the basic chemical composition of the adhesive unchanged, this area may be shifted up or down the temperature scale by adjusting preheat, curing temperature and time.

Application

In all applications, it has been found that the production reality of adhesive bonded structures requires the application of sustained effort and the accumulation of know-how by five distinct groups: involving the Materials Laboratory, Engineering Design, Tool Engi-

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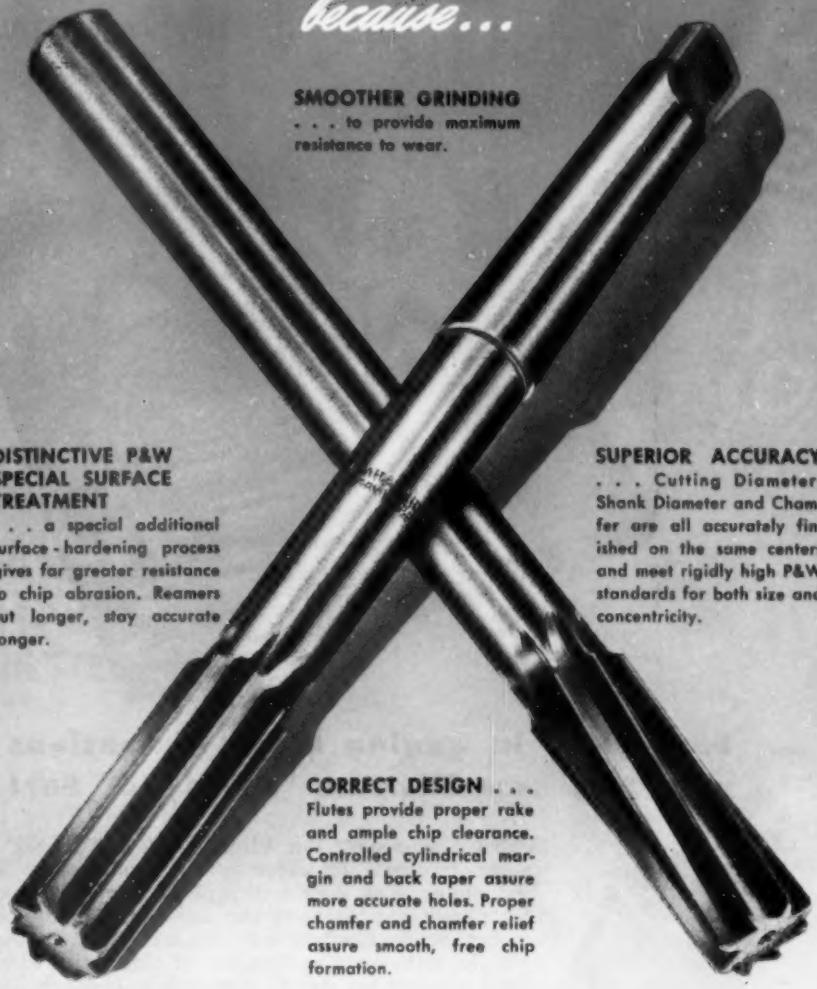

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neering, Manufacturing and Quality Control.

The lessons learned by this wave of effort were, primarily, as follows: A successful adhesive bonded design must be designed for adhesive at the outset. It must not be a conversion of a riveted design.

The designer must become familiar with and consider in greater detail the tooling problems with the tool engineer so that the configuration may be reproduced reliably and cheaply. For example, expansion of the materials during the heating cycle must be considered. This becomes a major problem in bonding materials having different expansion coefficients. Also the ability of the structure to withstand the pressures applied at the bonding temperature by the bonding tool must be considered.

Tools must be designed which assure the application of the required temperature and pressure at the glue lines.

For high rates of production and small, easily expanded facilities, electric bag-diaphragm bonding should be investigated, *Fig.* 2.

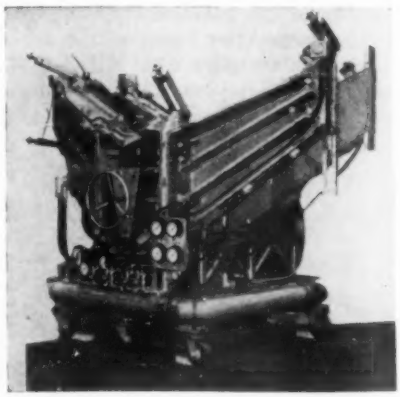

Fig. 2. Machine developed for electric bag-diaphragm bonding.

Mild forming or rolling of laminated sheets can be accomplished after the bonding process is complete.

The development of manufacturing know-how proved rather difficult. There are a great many people involved in the processing and the transition from the drill and rivet system to a 'glue" system is necessarily slow in the case of aircraft workers. Damage done by factory people is not always obvious at the time. Perhaps the most important watchword for those engaged in this activity is "cleanliness," and every individual contributes toward the objective from management down to helper.

From a paper presented at 1954 SAE Annual Meeting.

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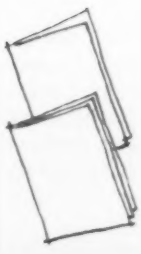

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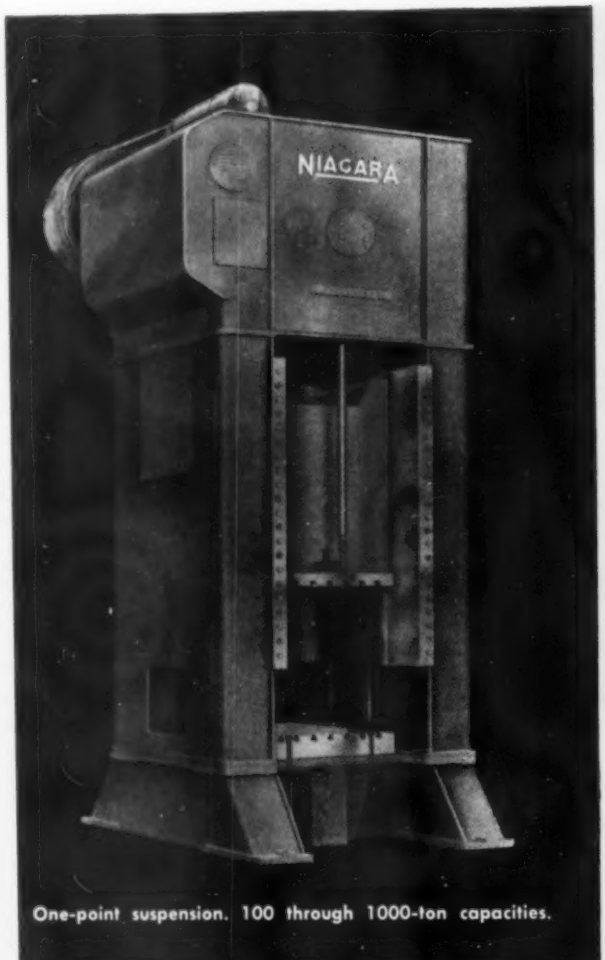

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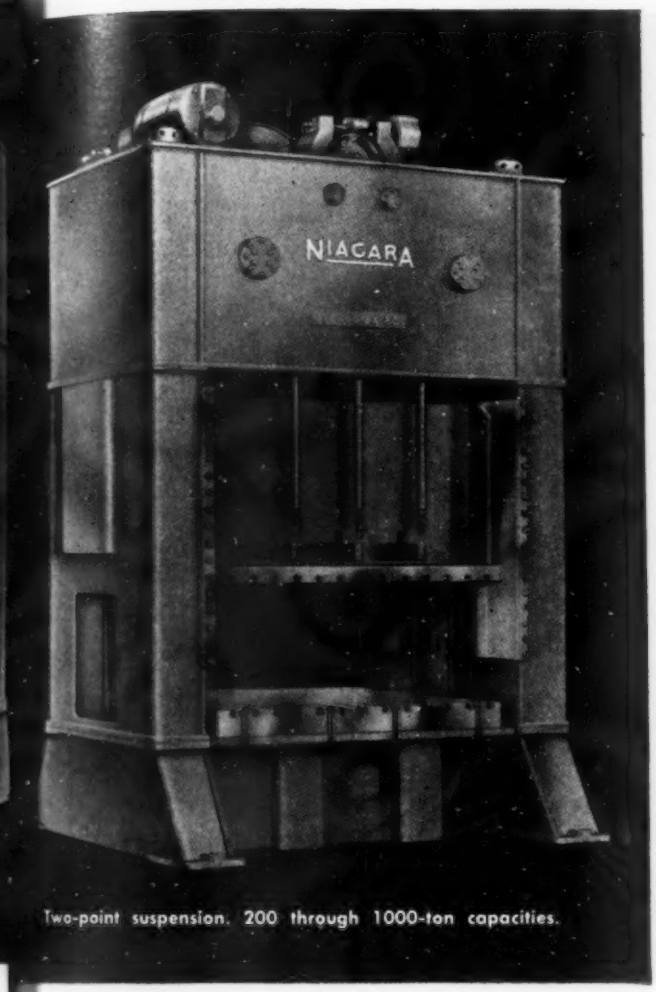

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Place spindle on most any machine. Use it for finishing contours on hardened steel working surfaces . . . burring or milling die castings . . . routing wood contours . . . carbide milling or finishing slots . . . finishing holes in hardened steel to "tenths" . . . grinding with diamond wheels, carbide burrs, or diamond impregnated mandrels.

Advantages—10 micro finishes using carbide mills . . . 6 micro finishes using mounted points, operates at any angle . . . air driven, air cooled, overheating prevented . . . speed controlled at optimum point . . . 3⅛" long motor uses little working space . . . By controlling speed at any point you abolish need for many constant speed spindles.

For immediate quotation please state machine tool application. Get this manual of photos showing operations Vulcanaire performs.

*Dependably accurate to "tenths"

Vulcanaire

It's built by toolmakers for toolmakers

MAJOR VULCAN SERVICES

Engineering, Processing, Designing and Building, Special Tools . . . Dies . . . Special Machines . . . including the *Vulcan Hydraulics that Form, Pierce, Assemble and Size.*

VULCAN TOOL CO.

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USE READER SERVICE CARD; INDICATE A-10-172-1

Keep OUT OF TROUBLE IN MAKING SET-UPS!

On tapping and reaming jobs you'll save yourself a lot of trouble and also a lot of time if you use a Ziegler Tool Holder in making your set-ups.

In the first place, it is unnecessary, as with ordinary tool holders, to make an absolutely accurate set-up in order to produce perfect work. Why? Because the Ziegler automatically compensates for inaccuracies of as much as 1/32" radius or 1/16" diameter.

This means too that the set-up can be made in shorter time—and time saved means money saved!

Get a Ziegler Holder and see how it will simplify the making of tapping and reaming set-ups.

W. M. ZIEGLER TOOL COMPANY

13574 AUBURN DETROIT 23, MICH.

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Ziegler ROLLER DRIVE **FLOATING HOLDER** *for* **Taps** *and* **Reamers...**

USE READER SERVICE CARD; INDICATE A-10-172-2

...at the flip of a single page

Make drill jig designing easier with this "Flip-a-page" catalog.

Free on Request

COLONIAL BUSHINGS INC.

31780 GROESBECK HIGHWAY
FRASER, MICHIGAN

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"STANDARD for cutting metal and costs since 1881"

Red Shield says:

Cut machining costs . . . standardize with Standard. Complete line . . . top quality tools. Backed by factory application specialists coast to coast. Distributors in all principal cities.

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FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

EXCLUSIVE L&I

New Comparative N

NOW for the FIRST TIME a COMPARATIVE NET PRICE SELECTOR for stock REAMERS arranged by DECIMAL DIAMETER. L&I Net Price Selector immediately locates price of every reamer available in a given size.

Boon for Buyers and Users . . . Now you can choose the size and type you want at the price you want to pay. Arranged by decimal equivalents, easy-to-read charts show every standard size from .0400 thru 3.0000 including Fractional Sizes, Wire Gage Sizes, Jobbers' Sizes, Letter Sizes, Decimal Sizes plus Die Makers' Reamers, Expansion Reamers . . . the works . . . and every reamer is available FROM STOCK.

The L&I Net Price Selector will cut your buying and trying time in half. Get one now from your L&I Distributor or mail the coupon.

L&I's complete line of Quality Reamers makes it your No. 1 source for all your reamer needs.

makes **P**ricing
Quality
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Type
asy as **A**—locate diameter wanted
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C—NET Price at intersection of columns

Net Price Selector

BUYER'S BONUS

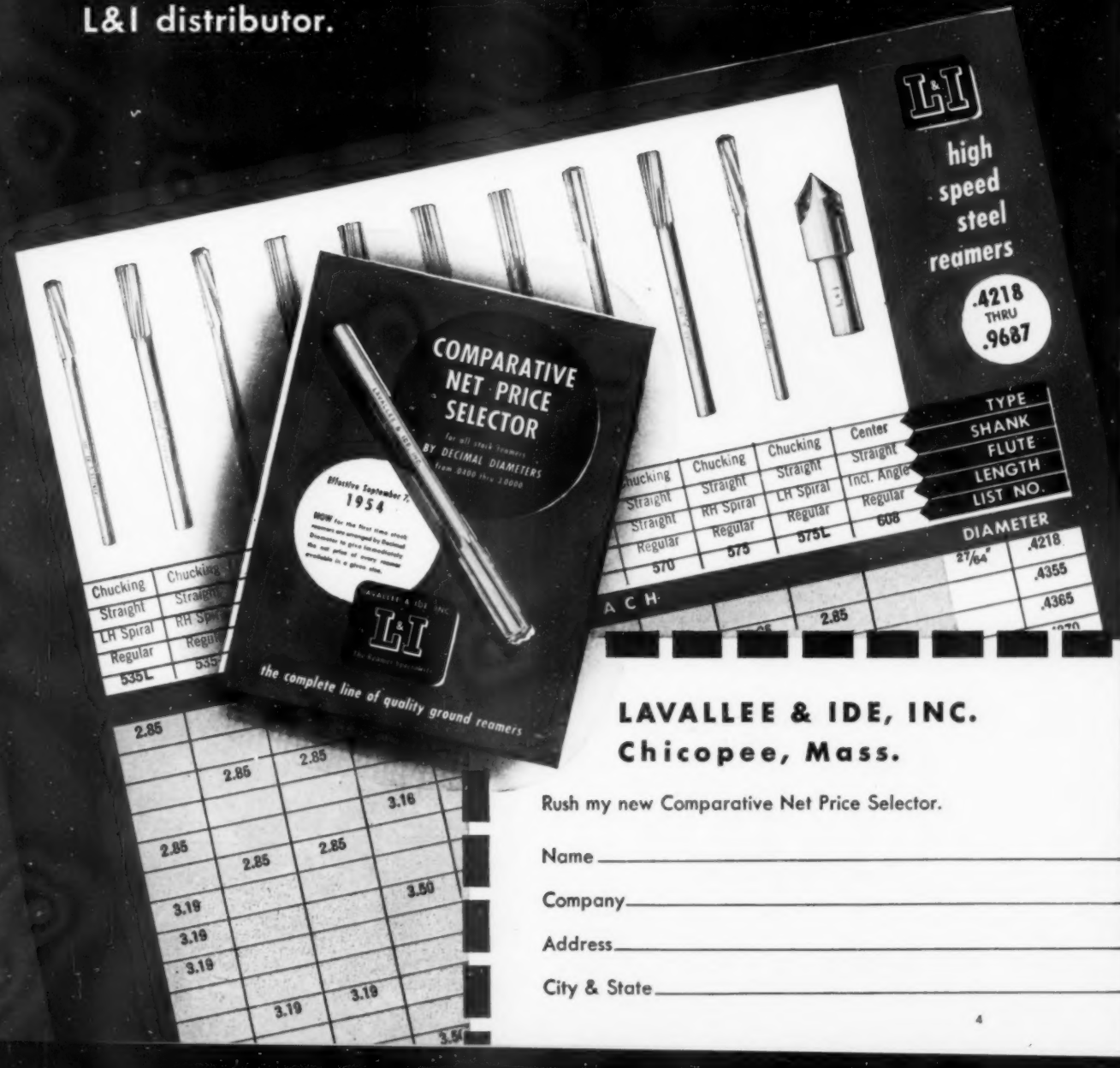
L&I is first again with two more standards to make "the complete line of reamers" even more complete:

1 - New King Size Reamers in a full line of sets.

2 - New line of Spiral Flute Reamers with both ***right*** and ***left*** hand spiral standard.

USER'S BONUS

L&I offers a free sample reamer for trial in your plant to prove the economy of L&I quality . . . ask your L&I distributor.



LAVALLEE & IDE, INC.
Chicopee, Mass.

Rush my new Comparative Net Price Selector.

Name _____

Company _____

Address _____

City & State _____

The sweetest story ever told—

on AIR and HYDRAULIC POWER!

Rivett Hydraulic Cylinder Catalog Section 106 —
Details: Cushioned and non-cushioned, standard rod and 2:1 over-size rod, single and double end rod, internal and external threads, all standard mountings in 2" to 10" bores. Offered for 1500 P.S.I. 3000 P.S.I. available.

Rivett Hydraulic Valve Catalog Section 204 —
Details: 4-way, 3-way, pilot, and remote valves in 6 types of operation, 4 types of action, 7 sizes, 5 piston designs. Offered for 1500 P.S.I. 3000 P.S.I. in most models.

These five books, totaling 68 pages, are jam-packed with all the important and necessary data required to lay out successful air and hydraulic circuits. Over 450 Rivett models, in a variety of sizes, are detailed — every standard air and hydraulic component offered in the industry. Description of each model includes working drawings, specifications, and cutaway views. All data pertaining to each model is shown on one page to facilitate layout. Easy to use, complete in information, these Rivett catalogs are a must on every board. Write to Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

454 standard Rivett models described!

—All the necessary components for any efficient circuit.

Rivett Hydraulic Power Unit Catalog Section 400—
Details: Single, double and combination pump types. Single—.4 G.P.M. to 40 G.P.M. at 1000 P.S.I. Double—3.5 G.P.M. to 48 G.P.M. at 1000 P.S.I.

Rivett Air Cylinder Catalog Section 55—
Details: Cushioned and non-cushioned, single and double end rods, internal and external threads, 7 standard mountings in 1½" to 12" bores. Offered for 150 P.S.I. air and 300 P.S.I. oil services.

Rivett Air Valve Catalog Section 303—
Details: 4-way and 3-way, pilot and remote valves in 5 types of operation and in 5 sizes. Offered for 150 P.S.I. service.

Rivett Lathe & Grinder, Inc., Dept. TE-10 Brighton 35, Boston, Mass. Please send me: ☐ Hydraulic Cylinder Catalog 106 ☐ Hydraulic Valve Catalog 204 ☐ Hydraulic Power Unit Catalog 400 ☐ Air Cylinder Catalog 55 ☐ Air Valve Catalog 303

Name_____ Company_____

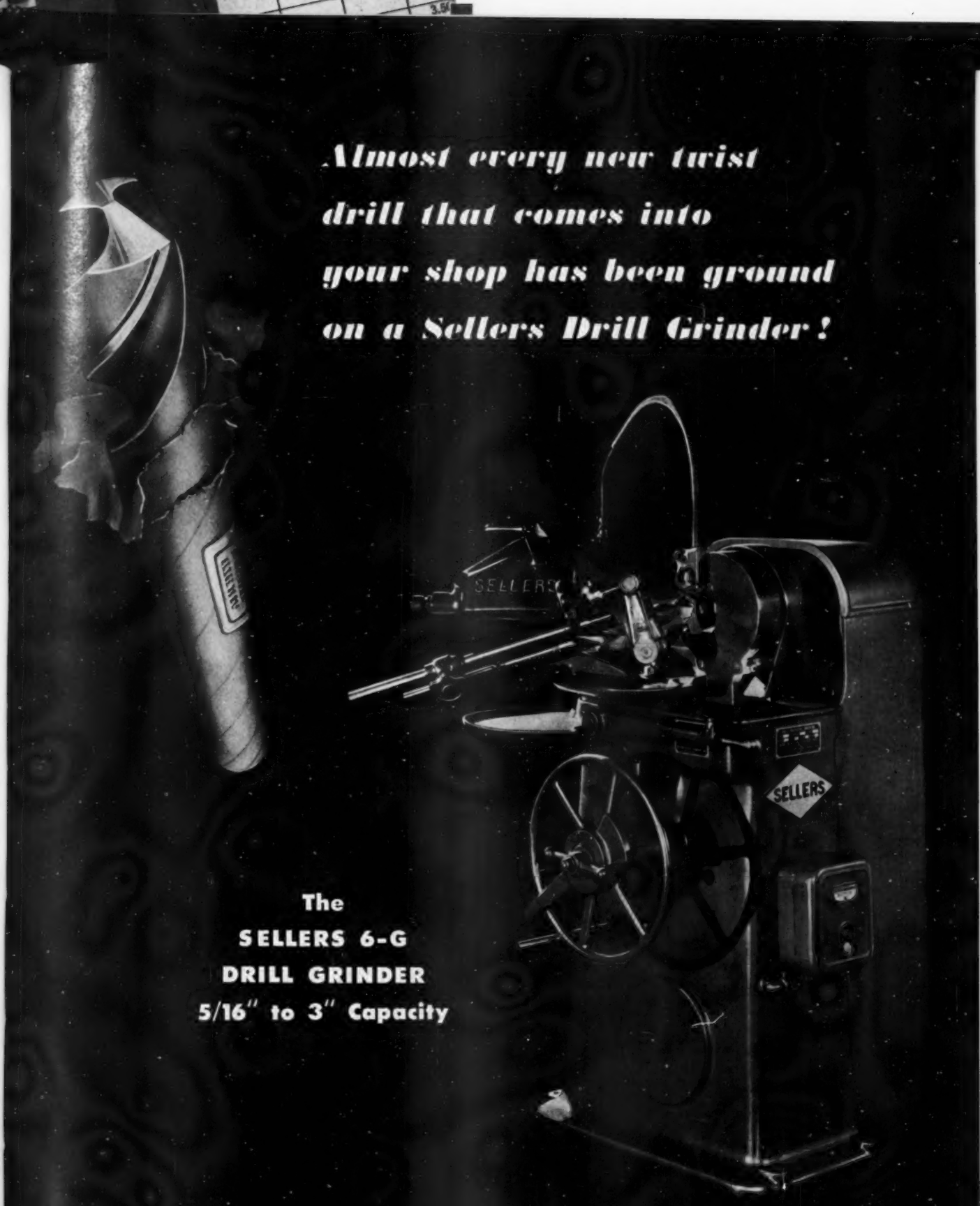
Address_____ City_____ State_____

RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS

Air and Hydraulic
All sizes and types

Almost every new twist drill that comes into your shop has been ground on a Sellers Drill Grinder!



The
SELLERS 6-G
DRILL GRINDER
5/16" to 3" Capacity

CONSOLIDATED
MACHINE TOOL CORPORATION

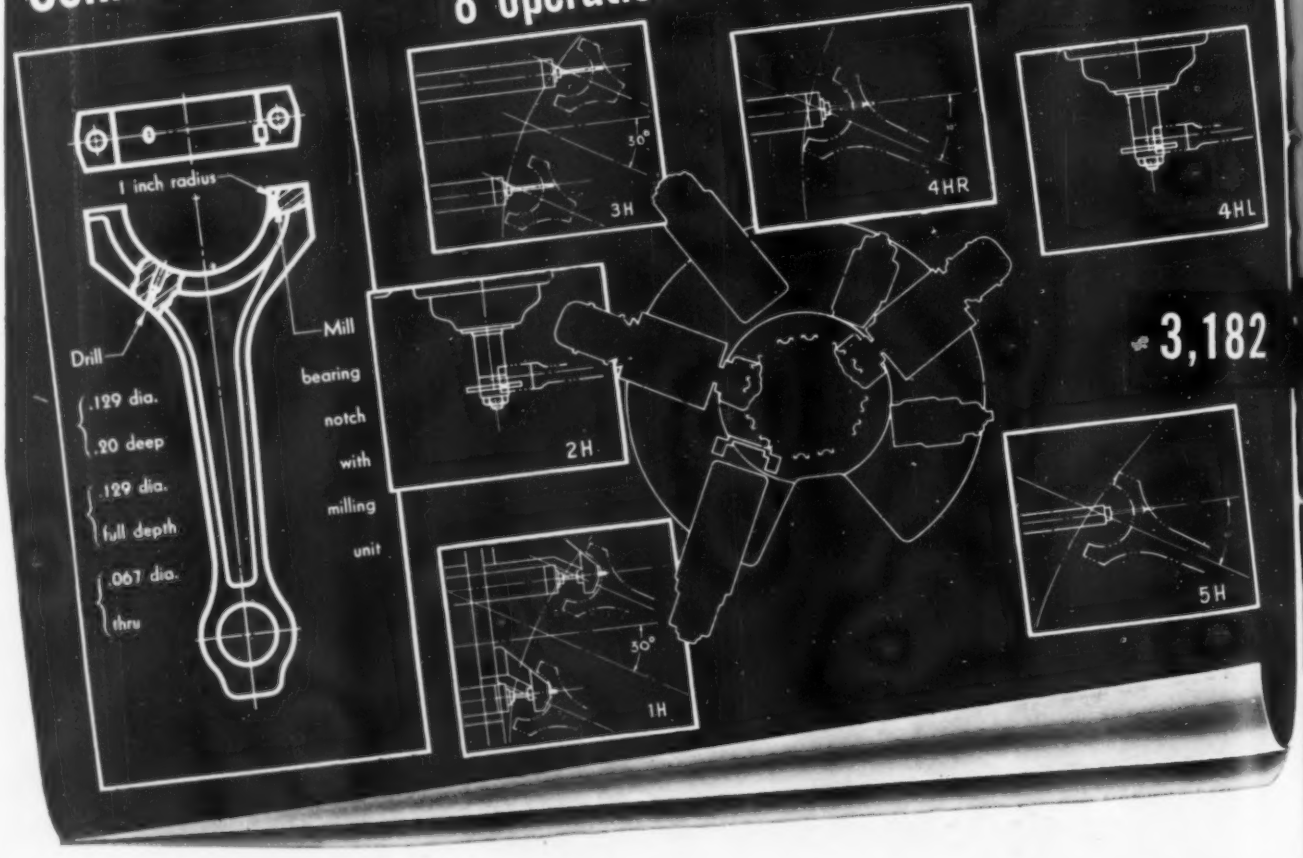
WHOLLY OWNED SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

"Operations Kingsbury" . . . required accuracy, low cost, hig prod

Connecting Rod Forged Steel 8/10¢ each

8 operations on 2 parts in one cycle



3,182

production for interchangeability

Here are two Kingsburys, custom-built to serve in widely separated product fields. Each justifies its investment. One drills a small hole and mills a notch in a forged steel connecting rod. The other works on a cast aluminum sole plate for a steam iron: drills 26 holes and spot-faces a boss.

Could this work be done on single-operation machines? "Yes." But could the connecting rods be machined for eight-tenths of a cent each? And the sole plates for one-and-one-fifth cents each?

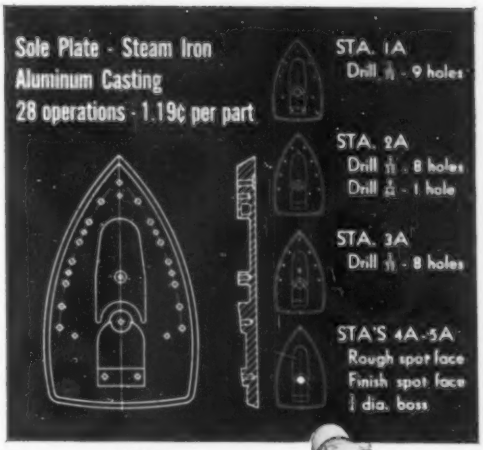
Kingsburys have so many advantages. For example: One work fixture positions the part for each successive operation. Standard units perform the operations within a pre-determined time cycle to obtain the best output with required accuracy. Tolerances are held to specifications. Scrap loss is reduced to a minimum. Floor space is saved. Handling is reduced. One operator loads and unloads the machine. And your parts will be interchangeable, reducing your assembly time.

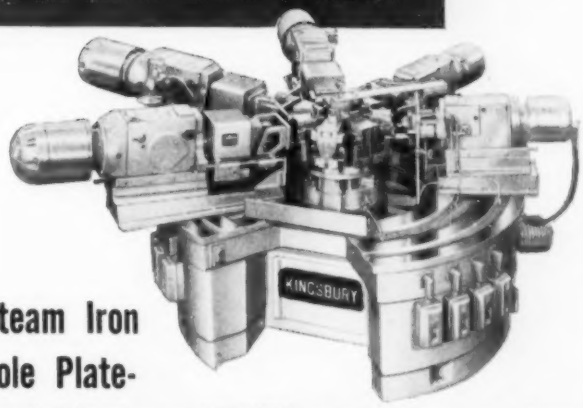
You can drill, spot drill, flat-bottom, ream, burr-ream, counterbore, countersink, mill, end-mill, hollow-mill, tap, thread, face, spot-face, form, recess, saw, trepan . . . all within certain limitations. For instance: Your product must be such that it can be machined within the limits of 5 HP units, and of a size and/or weight that can be handled efficiently by an operator.

We have some interesting bulletins we shall be glad to send you. Perhaps you manufacture a part where a few cents saved would put you in a better profit position and pay for the cost of a Kingsbury. Let's talk it over.

Kingsbury Machine Tool Corp.
107 Laurel Street, Keene, N. H.

KINGSBURY
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production





Steam Iron Sole Plate- Cast Aluminum 17,920 operations per hour

Here's a case where a Kingsbury really "gangs up" to get the work out! The part is a cast aluminum sole plate for a steam iron; 26 angular holes to be drilled and one boss to be spot-faced.

The machine has an 80-inch base and a 20½-inch diameter index table with 7 fixtures. Five drilling units are mounted on the base. Two of these have 9 spindles each, one has 8 spindles and two have single spindle heads to perform the rough and finish spot-facing operations on one ¾-inch boss. Bushings guide all tools.

The table indexes through five working stations. At Station 6, work is unclamped automatically and removed by the operator. At Station 7, the operator places new work in the fixture, where it is clamped automatically.

Operations per hour on two forged steel connecting rods

The problems: to drill a concentric step-down hole thru, at an angle of 30°, in each of two connecting rods; also to mill a notch in each rod for the bearing.

To obtain high production at low cost per part, the machine was designed to handle *two* parts in each work-holding fixture. Six Horizontal (H) Units are mounted radially on an 80-inch base. The 26-inch index table has six of these "twin" work-holding fixtures, automatically clamped and unclamped. The machine indexes through five work stations where eight operations are performed. The longer holes are drilled in two operations to maintain a balanced time cycle at each station. Bushings guide all drills.

Station 1, Unit 1 H has two-spindle head and drills one .129 dia. hole at an angle of 30° in each rod to half the required depth.

Station 2, Unit 2 H with milling unit mills the notch in the *right* hand part.

Station 3, Unit 3 H has two-spindle head and completes the drilling of the .129 hole in each rod.

Station 4, Unit 4 HR is a single spindle unit with sensitive feed; drills .067 hole thru from bottom of .129 hole in *right* hand part. *Unit 4 HL* with milling unit mills the notch in the *left* hand part.

Station 5, Unit 5 H is a duplicate of Unit 4 HR: drills .067 hole thru from bottom of .129 hole in *left* hand part.

Station 6: operator removes the two finished parts and replaces them with two new parts. Parts are unclamped and clamped automatically in the work fixture.

you can sharpen

4,800

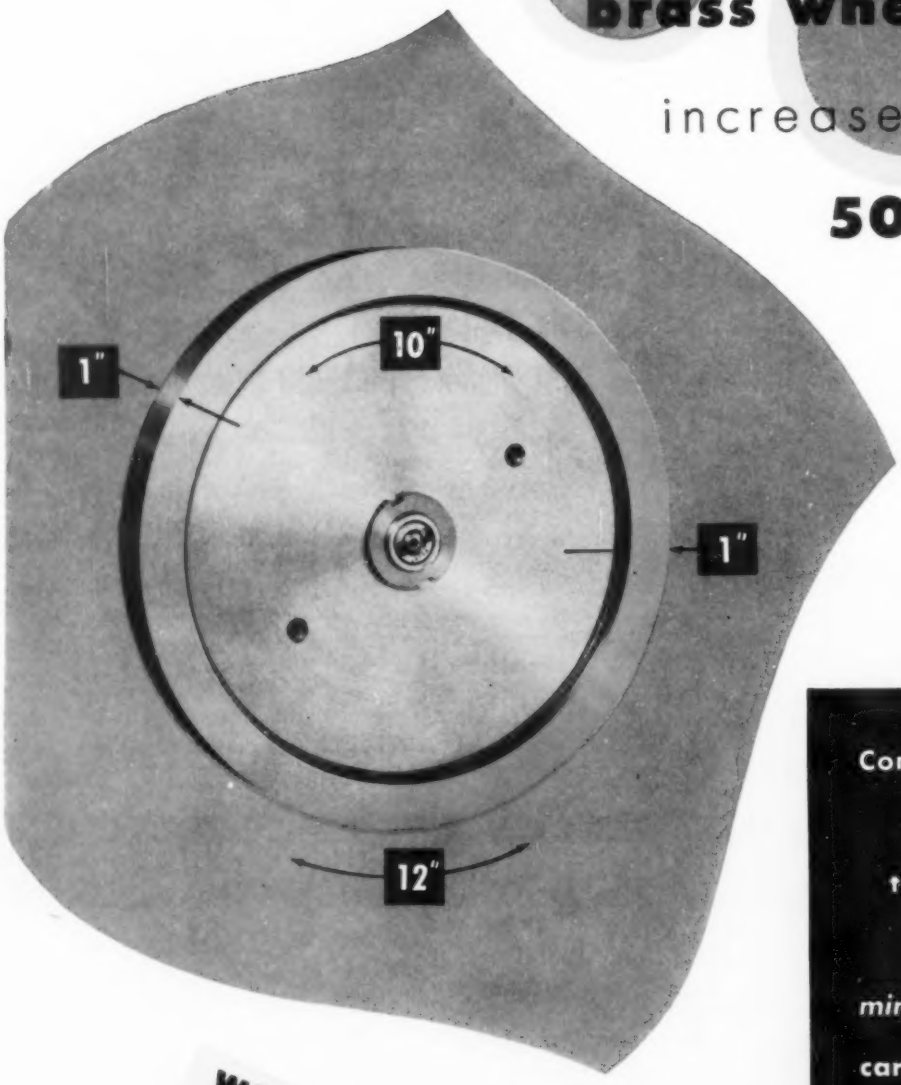
½ x ½ tungsten carbide

insert tools with this $45

brass wheel and

increase tool life

50 to 200%



Ave. cost per tool sharpened:

.009¢

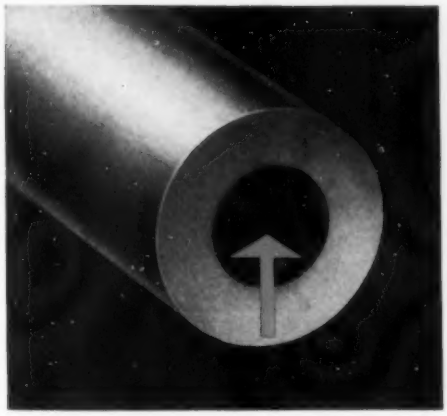
Convert from abrasive and diamond wheels to an Elox brass wheel and save 50 *minutes* sharpening 20 carbide insert tools.

WE CAN SHOW YOU HOW!

elox *corporation of michigan*

737 north rochester road • clawson, michigan

a hole here makes waste...



a hole here makes a saving

Crucible Hollow Tool Steel Bars **are a boon to the metalworking industry. The hole in these quality bars enable toolmakers to eliminate drilling, boring, cutting-off and rough-facing operations. This cuts production time, boosts machine capacity and saves scrap losses.**

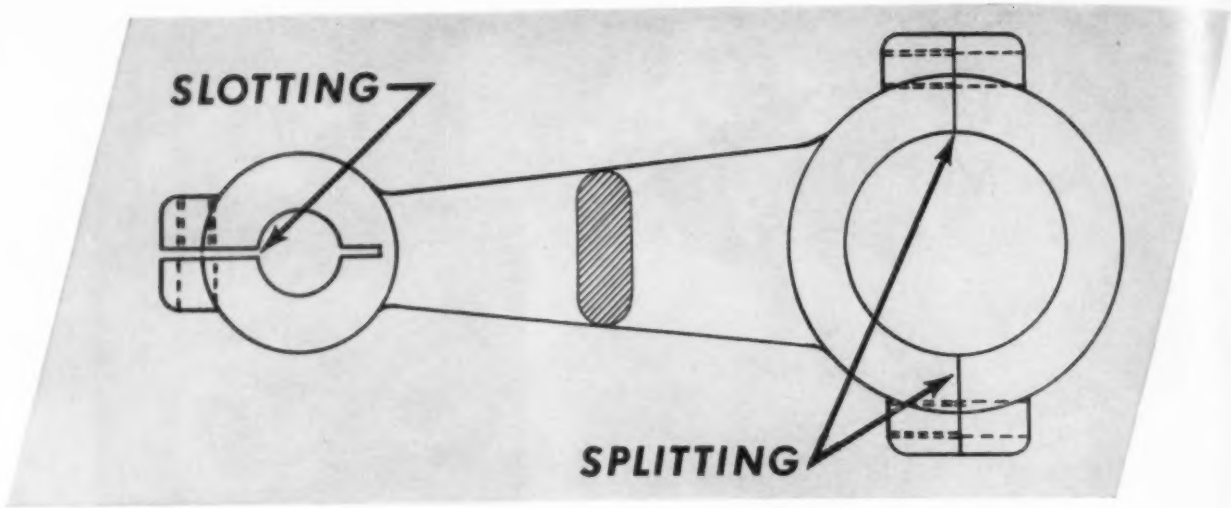
They are available now, in any of Crucible's famous tool steel grades, in almost any combination of O.D. and I.D. sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high carbon-high chromium, AIRKOOL air-hardening, and NU DIE V hot-work tool steels — from a conveniently located Crucible branch warehouse.

Let your Crucible representative show you how these steels can best help *you*.

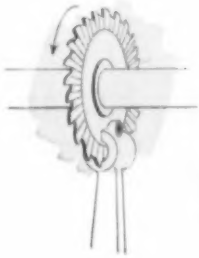
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **HOLLOW TOOL STEEL**

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.

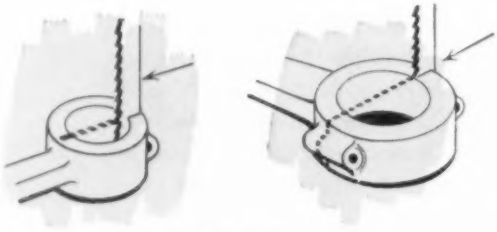


Here's a job for band machining!



THE OLD WAY

Slotting and splitting the part shown above would cost twice as much on a milling machine as on a DoALL band machine. And, use of the DoALL machine would free the much more costly unit for other work.



THE NEW WAY

For slotting, the band machine set-up time is less, cutting rate faster and tool cost lower than with milling.

Cutting at the rate of 4 to 6 or more square inches per minute the saw band makes short work of this splitting job.

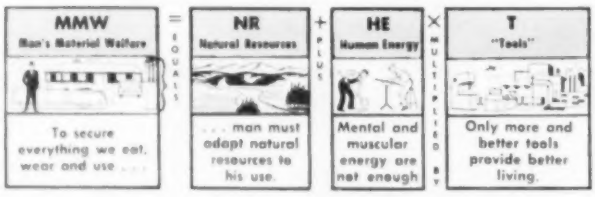
THIS is a representative part showing you two typical operations on which production band machining can cut costs a third to 50% or more. Slotting operations can usually be done best by power feed bandsawing. Splitting is another natural for this newest machining technique.

With the simplest fixtures to position the workpiece on the hydraulic power feed table, it is fed automatically into the continuous-cutting saw band. Upon completion of the cut the table automatically reverses.

Power feed, coolant system, wider speed range, greater power and new Demon *high speed steel* blades make new DoALL band machines amazing cost-cutters on production line operations.

Ask to see a free demonstration of production band machining at your plant. No obligation.

The DoALL Company, Des Plaines, Illinois.



Ask for free chart: "WHY LIVING IMPROVES IN AMERICA." 17" x 22"—suitable for bulletin boards. Contains no advertising.

DoALL band machines, saw bands, precision surface grinders, granite surface plates, tool steel and precision measuring instruments are available through 38 DoALL Sales-Service Stores which also stock a complete inventory of cutting tools such as taps, reamers, twist drills, cutters and single point tools.

DoALL

PB-5

Call DoALL—see classified directory for number of nearest store.

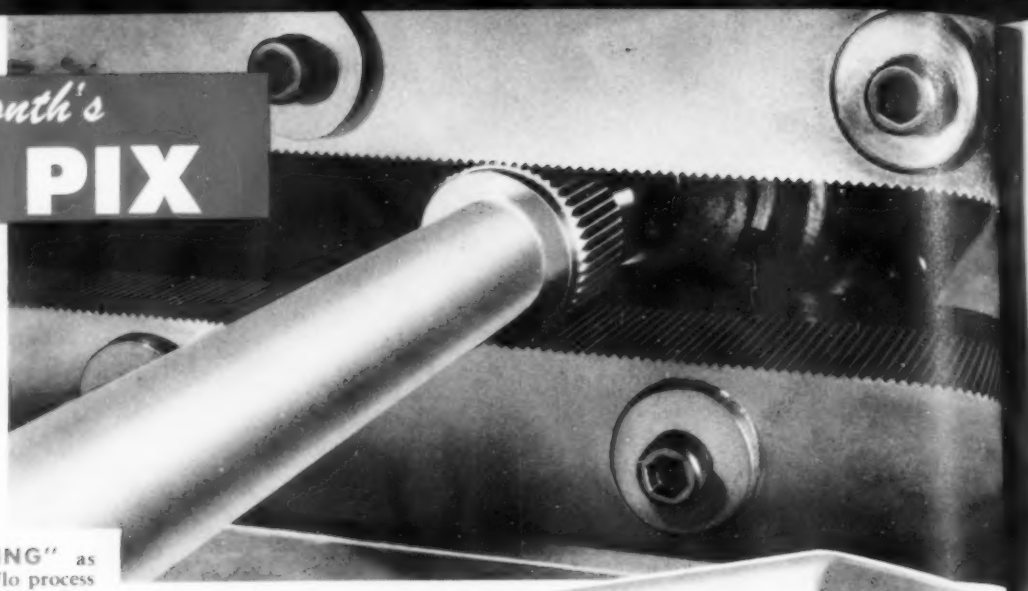
Fastest way to produce splines and similar shapes – ROTO-FLO spline rollers offer a new, accurate, cold-forming process to the metal-working industry. Helical spline shown was formed by this chipless process in 3 seconds – floor to floor in 10 seconds. Request Bulletin RF-54. More details on next page.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.

This Month's
GEAR PIX



"CHIPLESS MACHINING" as accomplished by the Roto-Flo process —a straight spline is being formed as it is rolled between the two forming racks. Roto-Flo produced parts have excellent surface finishes and are formed to close dimensional tolerances.

ONE of the standard models offered in the *Roto-Flo line is the 1537 with a capacity for rolling parts up to 2 inches in diameter. The stroke on these machines is variable, depending upon the size of the forming rack required for the part being produced.

SPLINES and other "tooth" forms, can be formed in a very few seconds by the Roto-Flo process, at a marked reduction in cost. As illustrated, this latest development by Michigan Tool Company in "chipless machining" presents designers with a new range of flexibility when specifying splines, serrations, and other similar shapes on external parts.

*Patent Pending

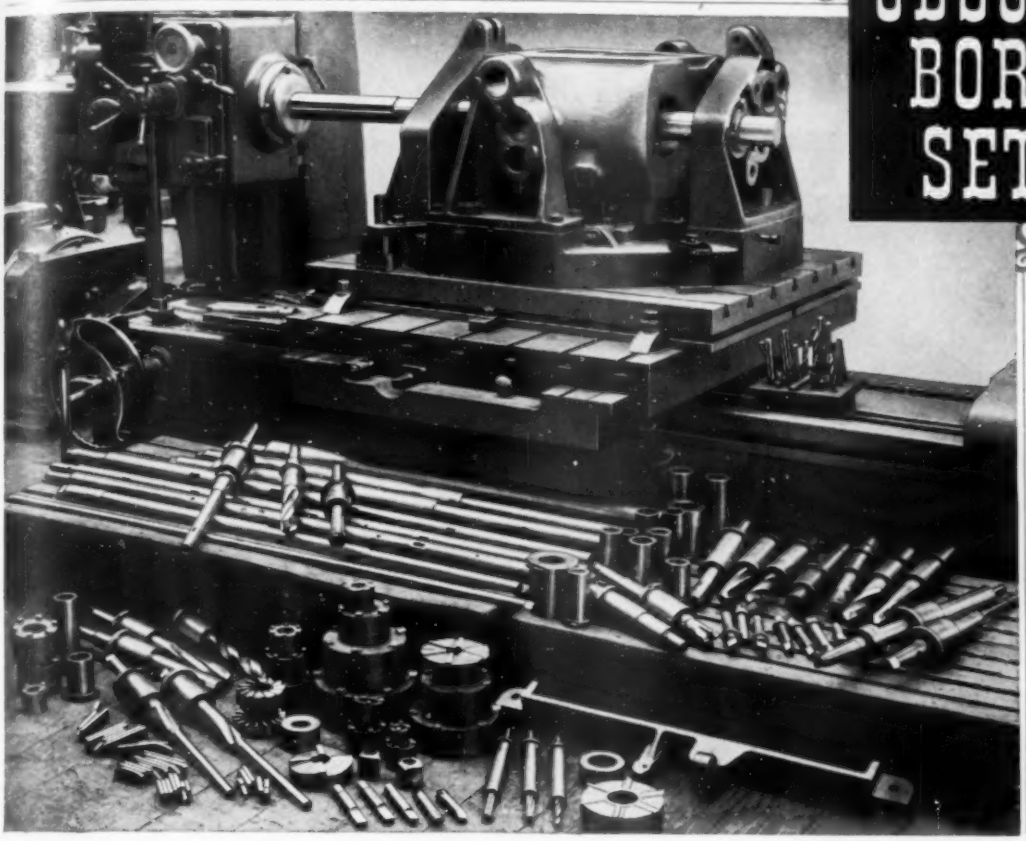
MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD., WINDSOR, ONT.

Here is a picture of an...

OBSOLETE BORING SETUP!

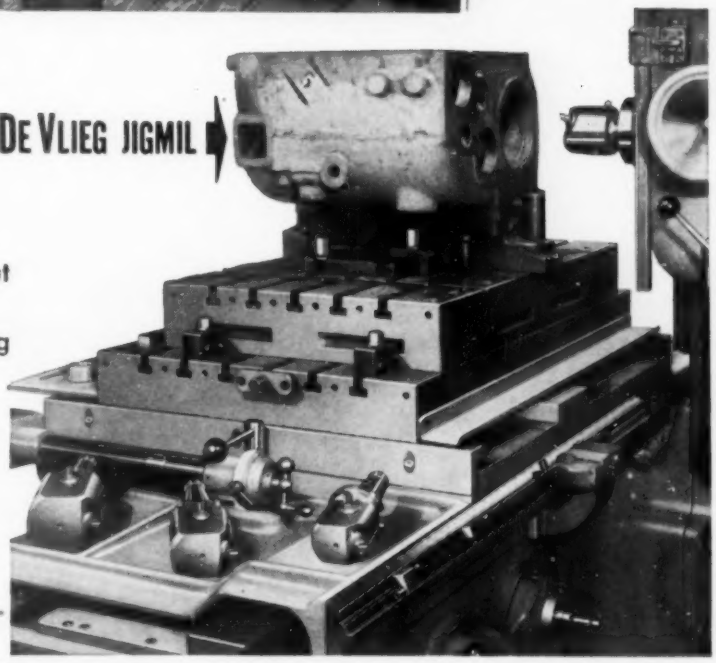


THIS PICTURE— taken in a well known machine tool plant illustrates the old method of boring turret lathe headstocks with a costly inflexible box jig and a mass of special tooling

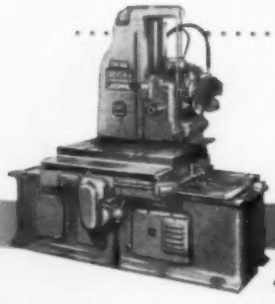
The Modern Method

"JIGLESS BORING" THE SAME PIECE ON A DE VLIEG JIGMIL

- Eliminated expensive boring jig
- Reduced machining time
- Improved accuracy with a resultant cut in assembly costs
- Permitted the use of simplified tooling



If your shop is burdened with costly boring jigs and special tooling, it will pay you to investigate the DE VLIEG SPIRAMATIC JIGMIL!



Come to Detroit... see a practical demonstration of the JIGMIL Technique ...

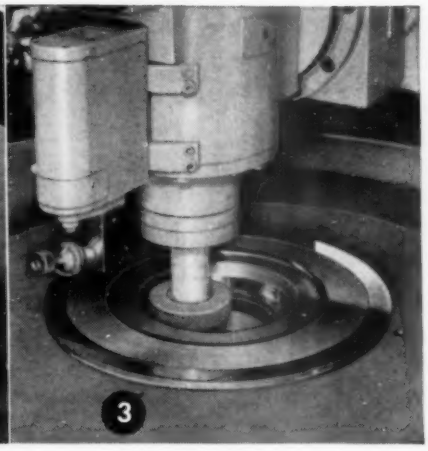
DE VLIEG MACHINE CO. • 450 Fair Ave., Ferndale • Detroit 20, Michigan

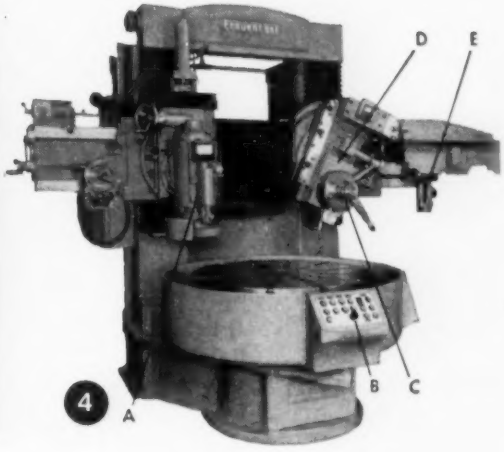
A request on your company letterhead will bring a copy of our comprehensive Illustrated Catalog

One set-up...
1

...and you can turn, bore and finish grind a single workpiece to close tolerances on the NEW FRAUENTHAL SERIES 3100 TURNING AND GRINDING MACHINE.

With it, you obtain unusual machining accuracies that assure concentricity of related surfaces.





WITH the new Frauenthal Series 3100 precision turning and grinding machine you get accuracies previously considered impractical.

Designed to meet the most exacting requirements of jet engine manufacture as well as other precision applications, the Series 3100 machine is new from the ground up. Its unique design presents a host of opportunities to put large and extremely close-tolerance jobs on a mass production basis. And the 3100 offers exceptional capacity for precision turning and precision grinding.

Check these salient features

- Ultra-precision work table bearings
- Hydraulically actuated turning slide
- Hydraulically actuated grinding slide
- Super precision grinding spindle
- Conveniently located controls and safety switches

. . . and this optional equipment

- Hydraulic tracer control
- Electronic table surface speed control
- Hydraulic wheel dressers for varied applications

Frauenthal Division

THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN

...about the pictures

PHOTO 1 shows how the operator uses a Series 3100 machine to finish bore the inside diameters preparatory to grinding operations.

PHOTO 2 shows the machine's contouring attachments being used to face the top surfaces of a workpiece.

PHOTO 3 shows how the machine performs close-tolerance finish grinding of the workpiece's top surfaces and inside diameter, to assure concentricity and squareness of related surfaces.

PHOTO 4 illustrates (a) grinding spindle with graduate swivel mounting, (b) push-button control panel, (c) five-station tool turret, (d) hydraulic actuated turning slide, (e) hydraulic tracer control (optional).

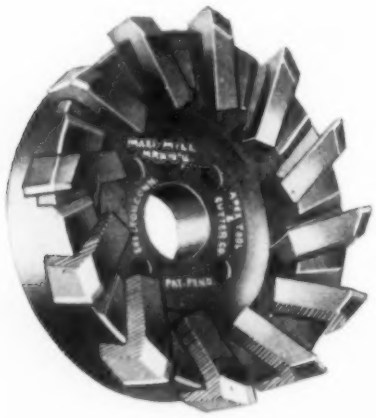
May we help you?

If you'd like further information on how the Series 3100 precision turning and grinding machine can give you production and/or tool room advantages — our engineers are at your service. Write for informative bulletin No. 301.

APEX TOOLS

"APEX" HEAVY-DUTY CUTTERS IN STOCK

We carry stock cutters for face milling, slotting or straddle milling. Your inquiries invited.



"APEX" manufactures inserted tools and milling cutters of all styles. Carbide-tipped cutters furnished when required.

APEX TOOL & CUTTER CO., Inc., Shelton 16, Conn.

USE READER SERVICE CARD; INDICATE A-10-188-1

GEORGE L. *Detterbeck Quality Tools*

SPEED UP
Screw Machine Production

SELECT YOUR NEEDS FROM THIS LIST

We specialize in

- CUTTING CAMS
- HIGH SPEED STEEL AND CARBIDE FORM TOOLS
- SPECIAL CUTTING TOOLS
- SPLIT DRILL BUSHINGS
- CROSS SLIDE KNURL HOLDERS
- TOOL BITS
- BOX TOOLS
- BURNISHING TOOLS
- REVOLVING STOPS
- RECESS SWING TOOLS
- FORMING SWING TOOLS

Inasmuch as we manufacture cams and tools for the trade we obviously do so on a production basis. As a result we offer:

1. Superior type tools . . . at low cost.
2. Practical design based upon many years of experience.
3. Correct specifications which insures maximum service.

Your tool requirements in our hands is your guarantee of better tools at a great saving.

PROMPT DELIVERIES

Tool making with us is a routine matter. Special equipment . . . skilled hands . . . plus know how, enables us to fill orders in a minimum of time.

SERVICE

Let us quote on your tool requirements. You'll save money . . . even as compared with "home made" tools. Standard circular form tools for B&S and Davenport Machines carried in stock. Immediate delivery.

COMPLETE ENGINEERING

GEORGE L. DETTERBECK CO., Incorporated, 1871 Clybourn Ave., Chicago 14, Ill.
ENGINEERS TO AN INDUSTRY

USE READER SERVICE CARD; INDICATE A-10-188-2

FREE

DESIGN INFORMATION ON ROLLER GEAR DRIVE

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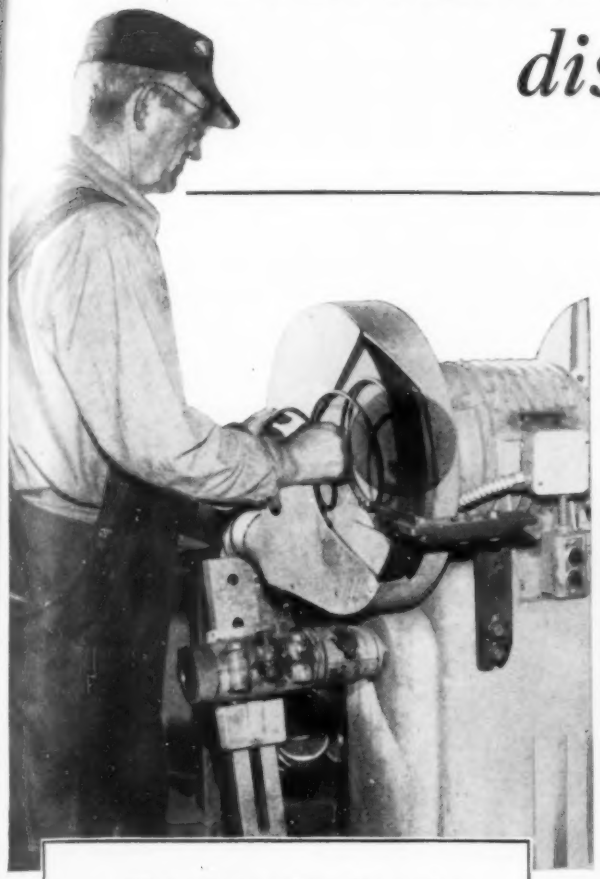
Norton covers the entire disc grinding range



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Whatever your disc grinding requirements may be, Norton will meet them exactly — with discs engineered for coolest cutting action and longest, most productive service life. Norton discs of ALUNDUM* and CRYSTOLON* abrasives are made in all grit sizes, all grinding grades, five types of bonds and all types of mountings. They are precision-built, by exclusive Norton processing, to assure closest uniformity of grinding action from disc to disc and lot to lot. Which means that each time you re-order to the same specifications, you'll get the same top performance — next week, next month or next year.

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and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
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*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

What Norton discs have done for others is good evidence of what they can do for you. Check these reports, typical of many from present users:

"Best discs ever received. Produced over 6,000,000 piston rings — 100% more than our former discs, with 50% less dressing. Results duplicated in subsequent shipments."

"Outlasted and outperformed all other discs — gave 366,975 pieces without burn."

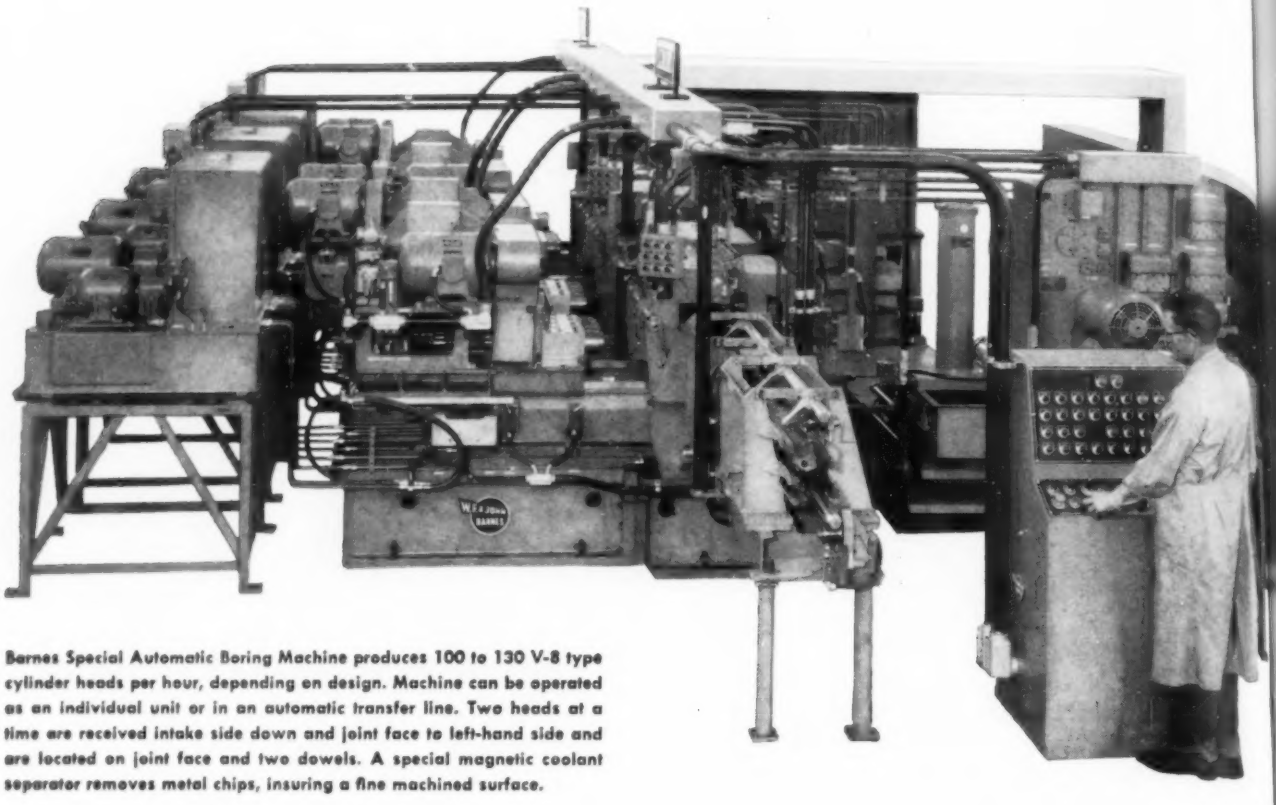
"Averaged 21,500 pieces, a new high for this job."

"Outproduced previous discs 2 to 1."

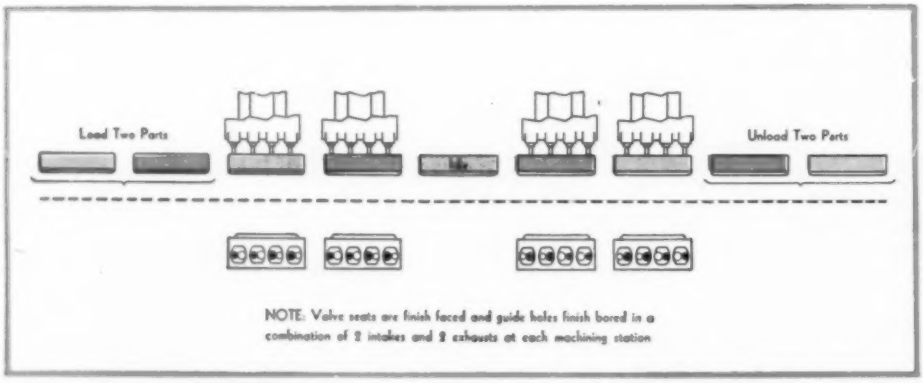
"High above competition for output and grinding quality."

"Gave 20% longer service life."

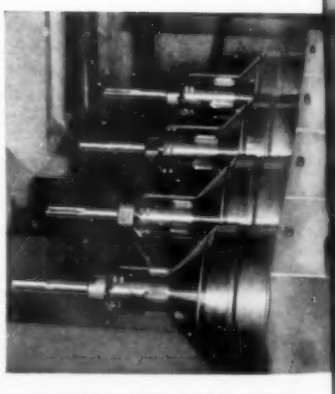
Announcing NEW P MACHINING AUTOMOTIVE V



Barnes Special Automatic Boring Machine produces 100 to 130 V-8 type cylinder heads per hour, depending on design. Machine can be operated as an individual unit or in an automatic transfer line. Two heads at a time are received intake side down and joint face to left-hand side and are located on joint face and two dowels. A special magnetic coolant separator removes metal chips, insuring a fine machined surface.


Load Two Parts
Unload Two Parts
NOTE: Valve seats are finish faced and guide holes finish bored in a combination of 2 intakes and 2 exhausts at each machining station

Schematic drawing of machine above showing tooling and machining operations. Color blocks illustrate how cylinder heads are transferred two at a time.



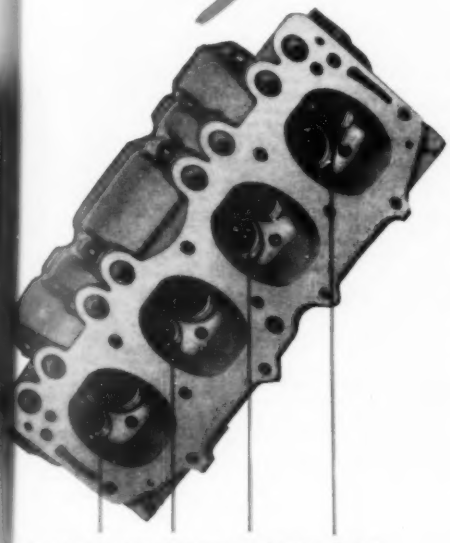
Closeup of 4-spindle head with special tools for machining four valve seats and stem holes in one pass. Second 4-spindle head completes remaining operations.

W. F. & JOHN BARNES

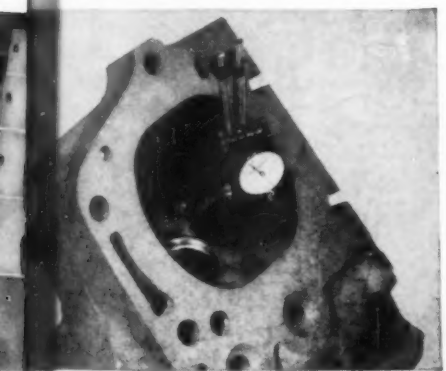
Builders of Better Machines Since 1872

MULTIPLE SPINDLE DRILLING • BORING • TAPPING

PRECISION METHOD OF FINISH VALVE SEATS AND STEM HOLES *Automatically*



Cylinder head for V-8 engine showing finish machined valve seats and guide holes. Red arrows indicate operations performed at first machining station.



Concentricity of valve seat and stem hole held to .0005" total indicator reading.

EXCLUSIVE W. F. & JOHN BARNES MACHINING DEVELOPMENT HOLDS TOTAL CONCENTRICITY WITHIN .0005"

Now, a new precision machining method developed exclusively by W. F. & John Barnes makes it possible for you to finish machine automotive valve seats and stem holes on a continuous automatic basis. You can now eliminate corrective operations after normal boring, reaming, and seating operations, because this new development holds total concentricity within .0005" (total indicator reading). This new machining process, as incorporated into Barnes Automatic Progress-Thru Type Machines, consists of multi-blade tooling for the valve seating operations, combined with modified gun drilling tools for precision boring valve guide holes. Production tests show the valve seat tools produce 10,000 to 15,000 parts, and the boring tools, between 2,500 and 4,000, before regrinding or replacement is necessary. The net result has increased production efficiency and improved product quality at lower cost. Write for more facts today.

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THEN

without machining you can:

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- Anchor spindles in abrasive wheels,
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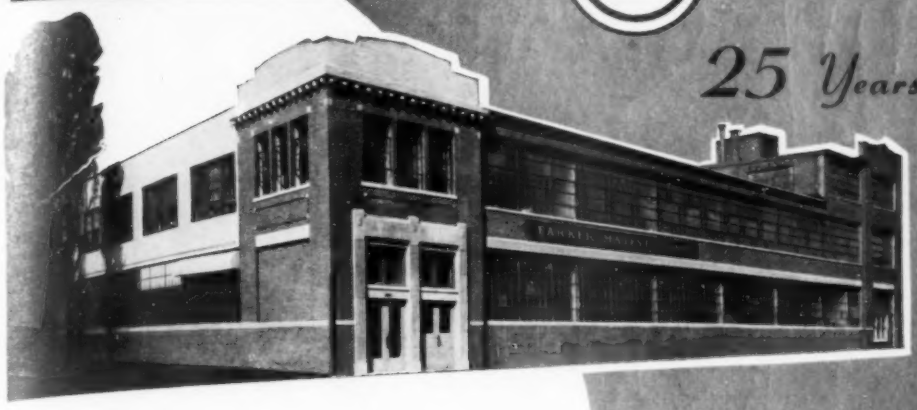

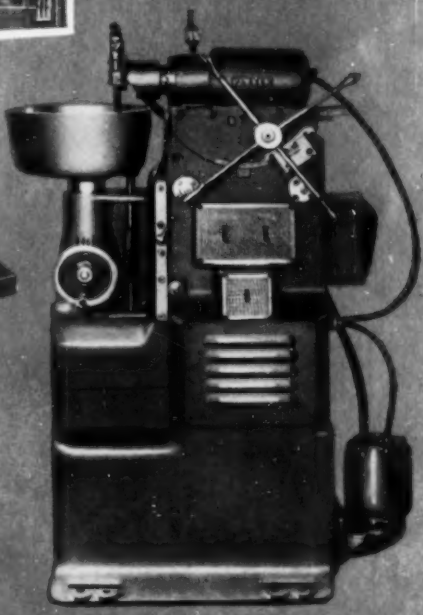

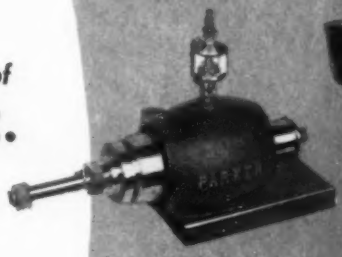

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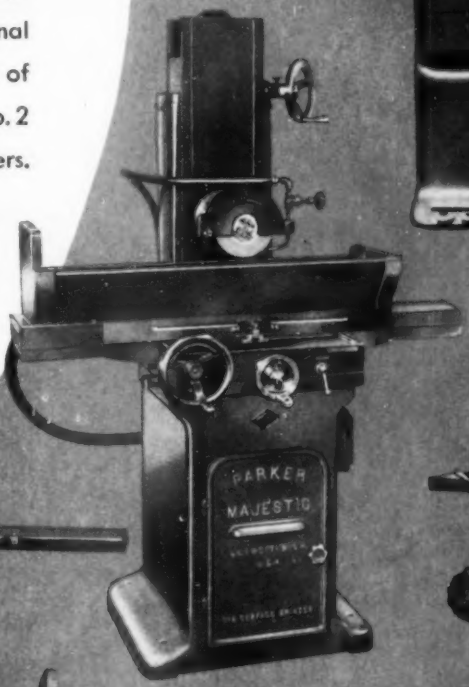
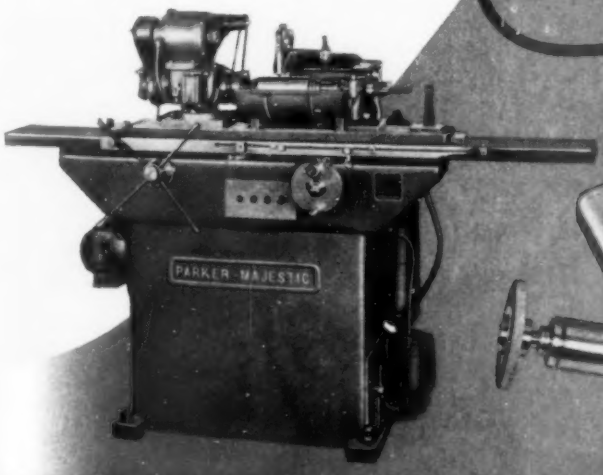
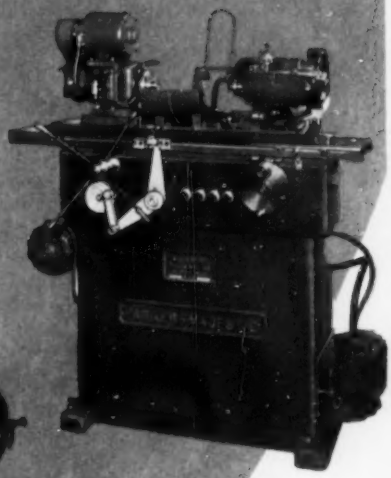
Established in 1929, this company has for 25 years manufactured the **Parker** Spindles used in Precision Grinding, Boring and Milling applications. Additional products include the well known line of **Parker-Majestic** Internal, External, No. 2 Surface and Rotary Surface Grinders.

Descriptive literature upon request.







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. . . THIS IS ANOTHER MACHINE

NATCO ENGINEERED
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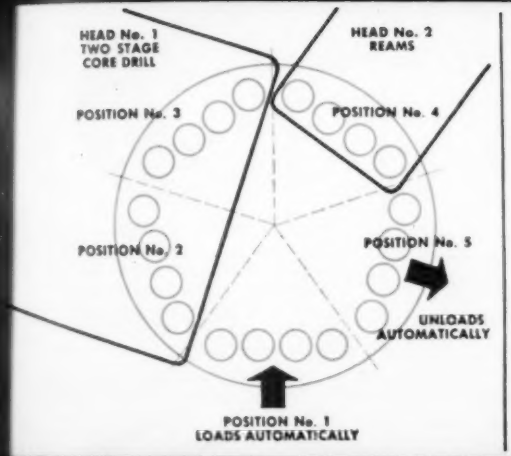
CUTS TRACK LINK BUSHING COSTS!

AUTOMATICALLY CORE DRILLS and REAMS SIX DIFFERENT SIZES UP TO...

400 PARTS per HOUR!



FIVE POSITION INDEXING TABLE WITH 20 CHUCKS, AUTOMATIC LOAD and UNLOAD

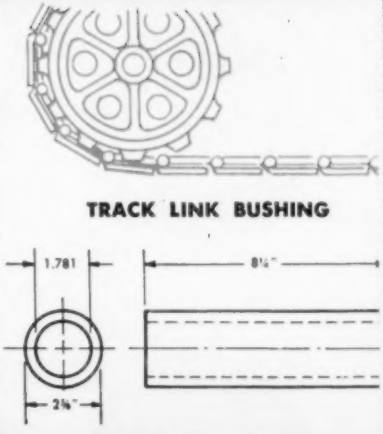
POSITION No. 1
Automatically loads four bushings . . .

POSITION No. 2
Core drills halfway through . . .

POSITION No. 3
Core drills through . . .

POSITION No. 4
Reams through to size . . .

POSITION No. 5
Automatically unloads four bushings.



This new NATCO HOLESTEEL automatic indexing machine core drills and reams six different size bushings ranging from 5" to 8¼" in length, 2⅛" to 2⅜" O.D. and 1.4375" to 1.781" I.D. at the rate of from 270 to 400 per hour estimated gross production. The production depends upon the size bushing being run. Estimated gross production is based on 85% of maximum capacity. The stock from which these parts are made is seamless steel tubing and approximately 1/16" of stock is removed in this core drilling and reaming operation.

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to help you solve your problems in Drilling, Boring, Facing and Tapping.

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What's the Best Fixed Gage For the Job?

Some tips from Taft-Peirce on the various types of fixed gages. Relative cost and wear resistance information will be furnished on request.

Plain Gages

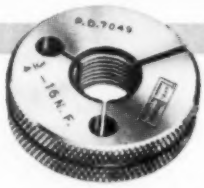
T-P Cylindrical Plug Gages come in 5 progressively greater wear resistances: Standard Hardened Steel, Electrolized, Chromium Plated, Tantalum or Tungsten Carbide, Norbide. Pilots: Progressive, Emmerton Ball Bearing, Taft-Peirce.

T-P External Ring Gages also come in 5 progressively greater wear resistances: Standard Hardened Steel, Electrolized, Chromium Plated, Tantalum or Tungsten Carbide, Norbide, for exceptional resistance to wear.

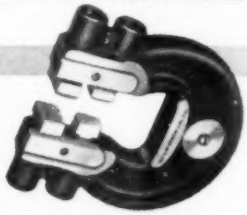
T-P Adjustable Snap Gages are available with gaging pins, round or square buttons, and regular or midget frames. Gaging members of high chrome alloy steel, Cemented Carbide or Norbide inserts.

Thread Gages

T-P Limit Thread Plug Gages are available with Taper Lock or Trilock design. In Standard Hardened Steel, Electrolized, or Carbide for exceptional wear resistance.



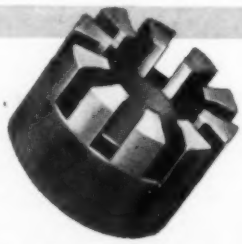
T-P Thread Ring Gages Simple unit clamping device simplifies setting, increases accuracy, eliminates distortion. Locks without changing pressure on ring.



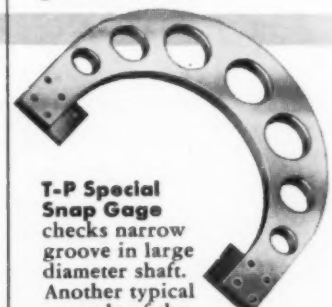
T-P Adjustable Thread Snap Gages Available with Tungsten Carbide anvils. Roll Thread Snaps give longer service life. Gaging members rotate to spread wear over greater surface.

Special Gages

T-P Taper Plug Gages are made to both standard and special tapers. Like T-P Taper Ring Gages they can be made in a wide variety of materials to fit the job.

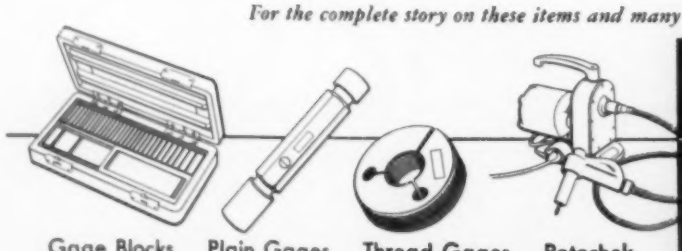


T-P Spline Gages, male and female, are made to individual requirements. Thousands of such special gages are made at Taft-Peirce every year.



T-P Special Snap Gage checks narrow groove in large diameter shaft. Another typical example of the wide variety of special gages made at Taft-Peirce.

For the complete story on these items and many more, send for your copy of the Taft-Peirce Handbook.



Gage Blocks Plain Gages Thread Gages Rotochek

T-P means Top Precision

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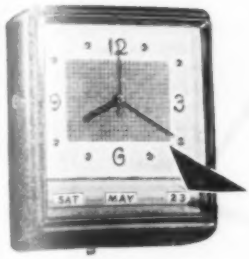
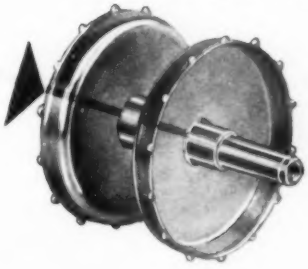
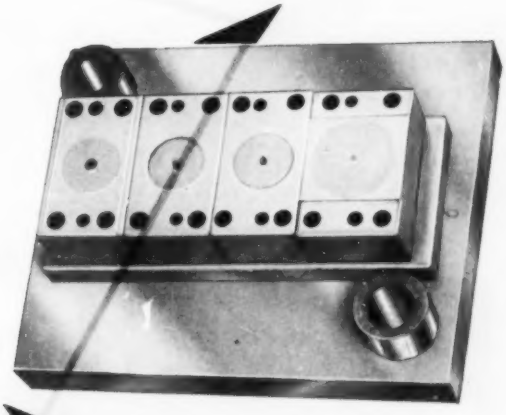
LUX CLOCK
keeps a date with

PRODUCTO

New design DIE SETS







In order for the date band on this Lux "date-minder" calendar clock to operate evenly and line up accurately, it is essential that the date drum sprockets, above, be concentric. This accuracy can be traced directly to the Producto die set which controls the stamping of this part. With a center hole tolerance of .001 and with a 6000-per-hour stamping speed, it is easy to see why the die set must be a highly precise, yet rugged, instrument.

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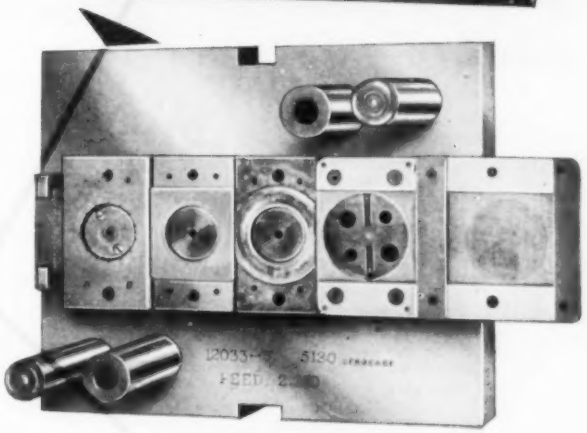
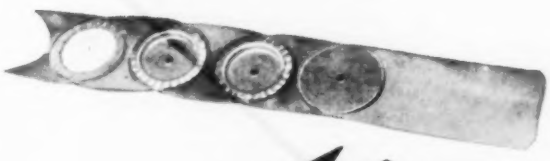
Whether catalog or special, every Producto die set is an instrument of precision.

For die set accuracy . . . call your nearest Producto branch.





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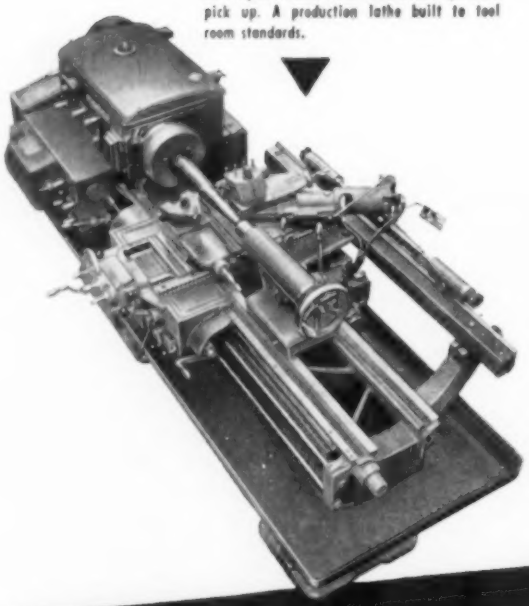
PRODUCTO

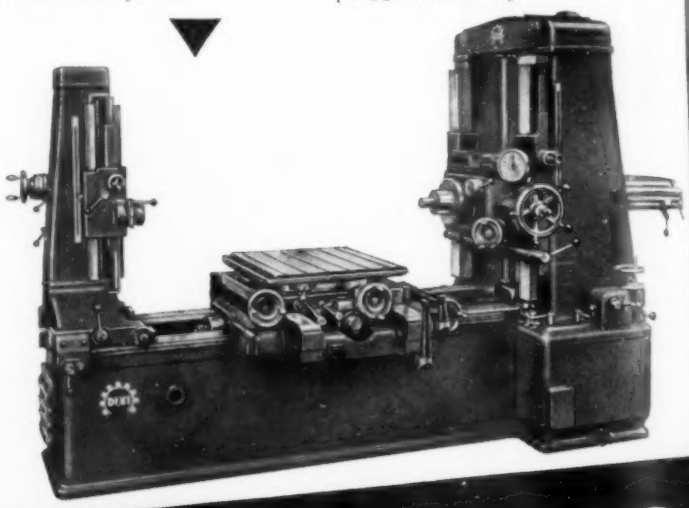
3PD54A

SCHAERER MODEL UN-450 HEAVY DUTY COPYING LATHES. Twin cross slides. Copies from cylindrical or flat template either longitudinally or cross. Twin slides permits rough turning and finish turning in the same operation in many instances. Swings 17¾"-20-5/64" over bed, 9" over carriage. Center distance 60" Spindle speeds 31.5 to 1400 R. P. M. Hydraulic copying attachment can be removed to permit use as a regular twin slide lathe when necessary. 10 H.P. motor drive to spindle. Separate motors for coolant and hydraulic pick up. A production lathe built to tool room standards.

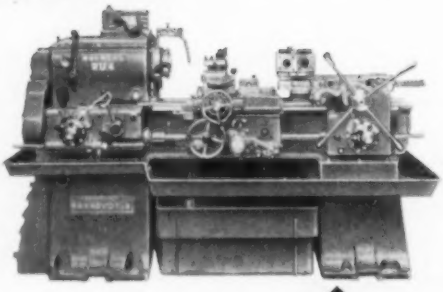


DIXI 60 COMBINATION HORIZONTAL BORING MILL AND JIG BORER WITH FIVE OPTICAL MICROSCOPES. Headstock, column, table settings accomplished by optical microscopes to insure overall accuracy of ± .0001". Built in rotary table also equipped with optical microscope for accurate angular settings. Table size 28¾" x 32⅝" Maximum distance table to spindle 19.7" Table travel—Longitudinal 23⅝"—Transverse 22¾". Hydraulic feeds for all functions 0– 78" per min. #40MM Taper spindle. Spindle travel 24.4". Spindle speeds 32-1350 R.P.M. Spindle feeds .0015"-.010" per rev.

New accessory precision circular dividing table considerably extends the range and advantages of the Dixi 60 by combining on one machine all the advantages of a horizontal boring mill with jig borer accuracy.



SEE THESE MACHINES



MAXNOVO MODEL RU 4 UNIVERSAL TURRET LATHE. Swing over bed 16-9/16". Swing over cross slide 9⅞". Capacity through spindle 2". Maximum distance spindle nose of face of turret 29½". Spindle speeds 64-1200 R.P.M. 8 power feeds to carriage .002"-.024" per rev. and 32 power feeds to turret .0005". .048". 8 or 12 H.P. motor drive. Machine can be furnished with air chuck, collet chuck, or bar feed attachment. The hexagon turret faces are machined and tapped to American standards and will accept standard turret tools of leading American manufacturers of this type of machine.

Our headquarters in New York City

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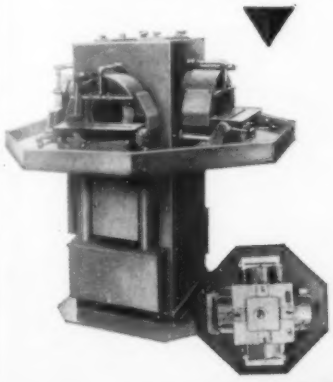
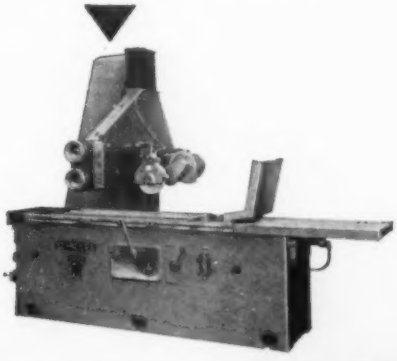
MACHBUILD NEW YORK

MBI

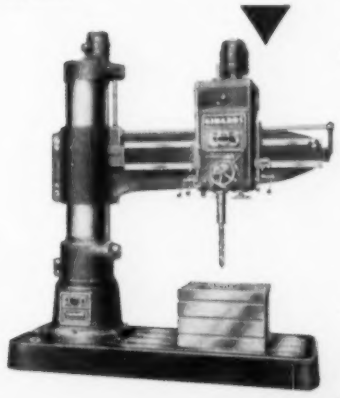
ART CARBIDE TOOL GRINDER. 4 work- positions. Three 12" silicon carbide cup heels and one 14" straight wheel. Individ- direct motor drive and separate control witch for each working position. Wheel speed 750 R. P. M. Provision for diamond dressing ool at each working position. MODEL TRIAX (not shown) same as below, but with 3 cup wheels and 3 working positions only.



SCHNEIDER HYDRAULIC UNIVERSAL HORIZONTAL SURFACE GRINDING MACHINE TYPE JoH. Grinding spindle adjustable through any angle from 0° to 90°. MODEL JoH1, 24" x 10" Table, 18" Under Wheel. MODEL JoH2, 48" x 16" Table, 22" Under Wheel. MODEL JoH3, 60" x 20" Table, 22" Under Wheel. Table feed infinitely variable 0-60 ft. per min. Traverse feed infinitely variable 0-.600".



GIRARDS RADIAL DRILLS. Seven Sizes from 3' arm x 11¾" column to 10' arm x 25½" column. 3' and 4' arm machines have 12 spindle speeds from 32-1400 R. P. M. and 6 feeds from .0015" to .040" with #4MT Spindles. Larger machines have 21 spindle speeds from 14-1400 R. P. M. and 12 feeds from .0008" to .080" with #5MT Spindle and 7.5 H.P. Spindle Motor.



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at Booth 125 National Metal Exhibition

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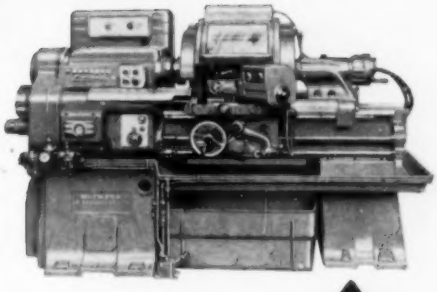
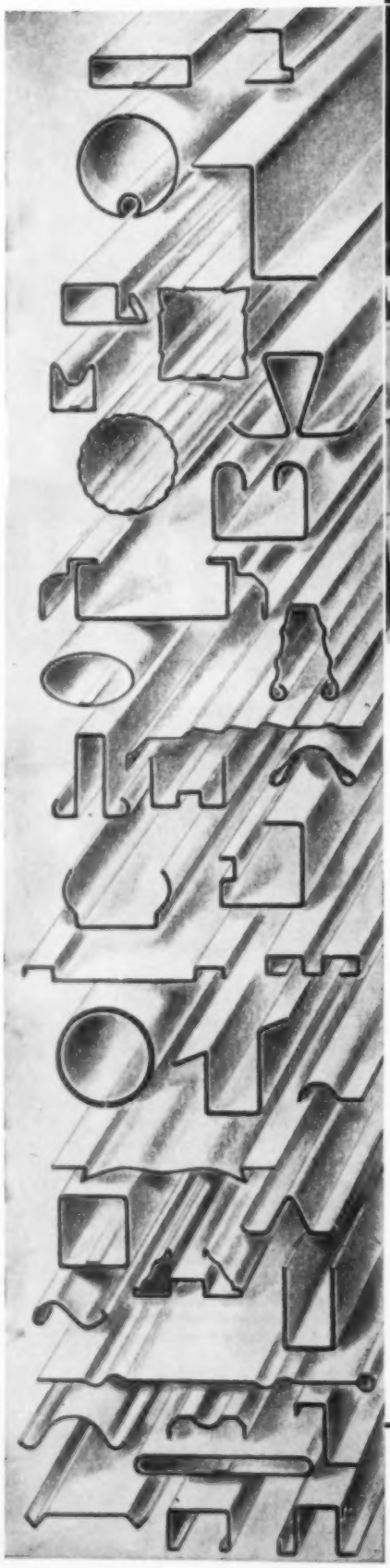
**Practically Every Machine Above.*

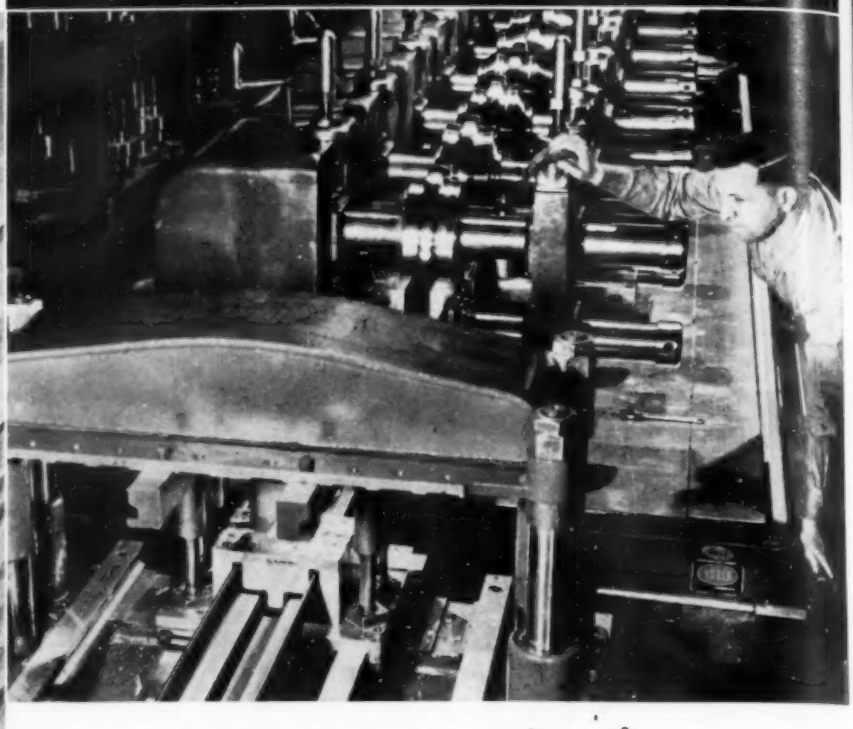


MAXNOVO MODEL A AUTOMATIC CYCLE "PROFILMATIC" DUPLICATING LATHE. 17" swing over ways, 4½" over across slide with 20", 30" or 40" center distance. This machine is equipped with air chuck and air tailstock to provide a completely automatic cycle with 2 or 3 automatic spindle speed changes and 6 or 12 automatic feed changes. Automatic speed and feed changes are accomplished by an automatic cycle control bar which is pre-set to operate precision microswitches at any point of the operating cycle. Copies from master template mounted at rear of machine out of the way of chips and coolant. 12½ or 15 H.P. drive. This machine can be furnished with complete tooling to produce parts in accordance with your blueprint.

MBI

Cold-Roll-Forming





simplest, fastest, most economical—

In the assembly of your products, to the wide extent that cold-roll-formed components can be used, substantial economies can be effected.

A Yoder Cold-Roll-Forming Machine with one operator and a helper will make upwards of 30,000 feet per day. Thus the cost usually is only a small fraction of a cent per foot for converting strip into structural shapes, trim, mouldings, panels, tubular or box shapes.

The machine may, therefore, be highly profitable even if operated only a few days per month. After you install it for a given purpose, you are likely to discover other things which can be done better and more cheaply on it than by methods heretofore employed.

You may also find it practical to combine other operations with cold-forming, such as curving, coiling, embossing, welding, perforating, notching, etc., at little or no extra labor cost. Yoder engineers are always glad to assist in making up such multi-function production lines.

The Yoder Book on Cold Roll Forming is a valuable source of information on the scope, mechanics and economics of the art. Send for free copy.

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Complete Production Lines

★ **COLD-ROLL-FORMING** and auxiliary machinery
★ **GANG SLITTING LINES** for Coils and Sheets
★ **PIPE and TUBE MILLS** — cold forming and welding

ENGINEERING YODER MANUFACTURING

Precision Holding

SPECIAL NEW PRODUCT EDITION

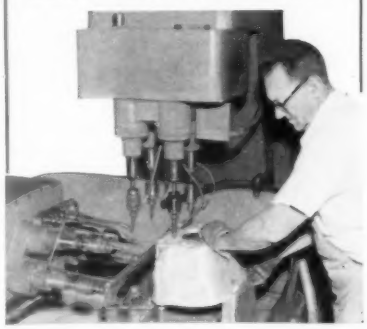
SCULLY JONES

NEWS

Published by Scully-Jones and Company
1901 South Rockwell Street, Chicago 8, Illinois

New Scully-Jones "Keyhole" Tool Ejector simplifies and speeds tool changes... makes machine accuracy last longer!

New Safe-Torque Tap Driver solves breakage problem



You saw it at the Tool Show in Philadelphia. It's a great new, adjustable torque, releasing driver for taps. Scully-Jones Safe-Torque Drivers are rapidly being adopted by tap users throughout the country. Reports show increase in tap life as high as 500%.

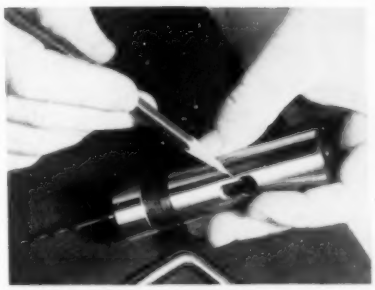
On the Buhr two-way tapping machine illustrated, for example, breakage is practically nonexistent after a year's operation, driving four 5/16-18 and four 7/16-14 taps for Class 2 holes in aluminum.

Other benefits reported include: increased over-all production; greater percentage of uniform, accurate threads; reduced scrap and rework on pieceparts; dependable operation; and closer, automatic control over tool wear.

Investigate this job-proved method for controlling adverse machining conditions, such as hard spots, poor chip removal, inadequate cooling or lubrication, and improper sharpening of taps. Write for Bulletin No. 20-50.

Prevents damage to bearings and spindles often caused by hammering

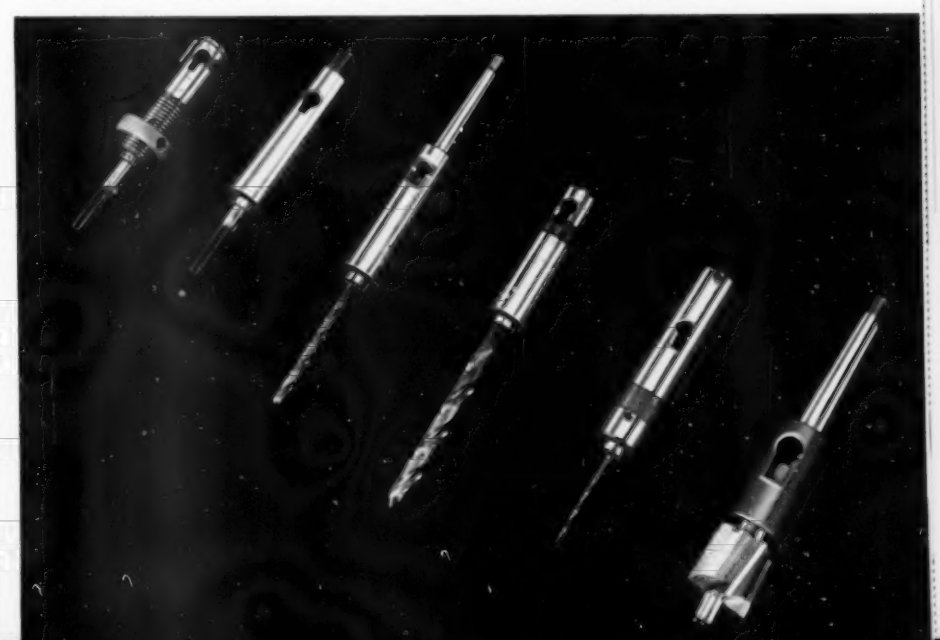
This new tool ejection system makes obsolete conventional methods of removing tools from holders and spindles by hammering. Damage to bearings and spindles may now be stopped because Scully-Jones "Keyhole" Tool Ejectors literally *push* tools and adapters out of the spindle. There are no axial stresses or shocking blows to break tools and spring spindles. Ejection is faster and easier. Stationary mounted in presetting gage plates, they're the ideal method for making tool changes with a minimum of operator effort. So, look for "Keyhole" slots in the new Scully-Jones Tools you buy. Write for details in Bulletin No. 14-50.



"Keyhole" slots will accommodate conventional drift keys as well as the new tool ejector.

Powerful force is exerted directly in back of the tool by turning the cam-shaped ejector.

"Keyhole" slots are now standard on adjustable adapters, sleeves and sockets, quick-change chuck collets, turret tool holders, and counterbore drivers manufactured by Scully-Jones.



New Scully-Jones Floating Holder provides trouble-free collet action...reduces down-time and damage to cutting tools

Style "JT" Floating Holders are available with adjustable adapter shanks for multiple-spindle machines, straight shanks for turret lathes and screw machines, and ASA or Morse taper shanks for machines having tapered spindles.

Short-coupled and compact, it answers all the needs of multiple-spindle tapping and reaming. The new "JT" Floating Holder provides *true float* . . . absolutely no "dead spots" or binding because its double-gear spline drive principle permits freedom of movement *in all directions.*

In addition, it gives you faster, easier ejection of tools, and improved collet action. The new split collet compresses evenly and powerfully on the shank of the cutting tool. Even in a close cluster of spindles, the new "lock and eject" chuck makes tool changes fast and easy. Operator merely turns the threaded nut on the nose of the holder to seat and unseat the chuck. The nut revolves freely on ball bearings and stays on the holder—eliminates the use of conventional drifts.

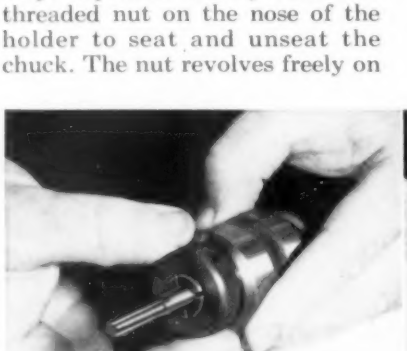
Guard against production of bell-mouthed, out-of-round, and poorly finished reamed holes. Control oversized and tapered threads, tap life, and downtime on multiple-spindle operations with this great new floating holder. It's the only holder today having separate *floating* and *driving* elements—a basic essential for true floating action. Available with or without centering pin in range of sizes and styles. Write for authoritative analysis of misalignment problems and solutions: "What to look for when selecting floating holders." (PRECISION HOLDING NEWS, Volume 1, No. 2.)

There's a correct Scully-Jones Floating Holder for every job

Four complete lines of Scully-Jones Floating Holders—all utilizing the exclusive double-gear spline drive principle—give you a free-floating holder for every job. Style "JAS," shown above, is for straight shank drills and reamers—available with straight, taper, or adapter shank.

Style "JA"—where overhang is no problem

New Style "JS"—for automatic screw machines and lathes



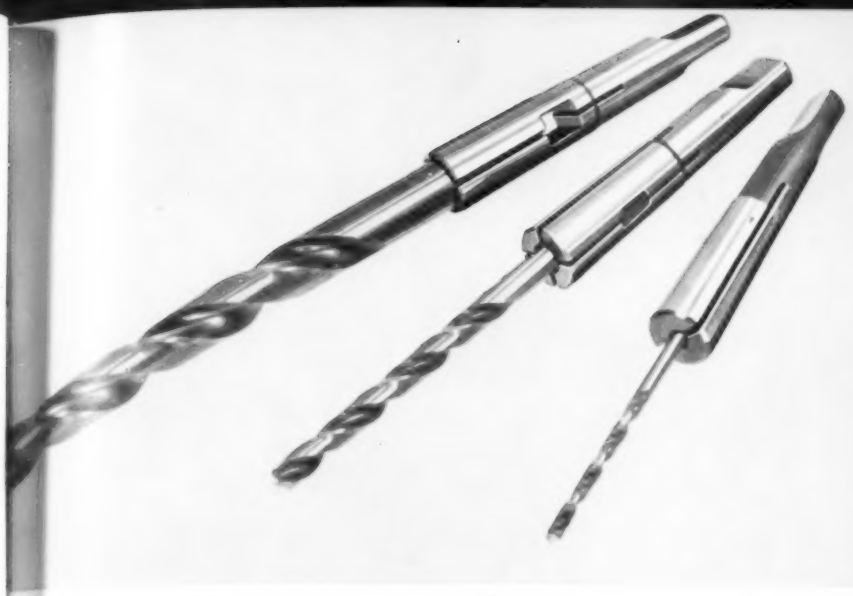
Threaded nut on nose of holder turns freely on ball bearings, drawing threaded chuck into tapered seat.

Chuck and cutting tool may be ejected separately or together by reversing rotation of the threaded nut.

New Tension and Compression Tap Holders have timesaver "Lock and Eject" Chuck

Improved design features quick, easy tool change without excessive torsion when locking taps in place . . . plus longer stroke, and wider range of application. Utilizing the same "lock and eject" collet design described above for floating holders, the new Scully-Jones Tension and Compression Tap Holders answer the need for reduced downtime and improved control over tooling problems on multiple-spindle machines.

Each size holder may now be used for a wider range of tap sizes. They eliminate the need for lead screw tapping in many operations because spring action compensates for variations of feed between spindle and tap. Permit use of various pitch taps without costly feed changes. Safeguard spindle and tap when previous operation fails to provide a drilled hole. Permit accurate hand feed tapping, and quick, easy depth adjustments on multiple-spindle setups. Give you positive drive and more accurate trouble-free collet action. Write for Bulletin No. 4-50.



New TOOLITROL speeds setup and tool changes

The new Scully-Jones TOOLITROL minimizes downtime and keeps production at near capacity for all types of multiple-spindle operations. Engineered to the job,

All tools, holders, counters, and signal lamps are arranged in attractively finished steel cabinet and keyed to machine stations, giving operator complete control over tooling problems.

it pays for itself quickly in reduced tool breakage, increased production, and longer tool life.

TOOLITROL eliminates cut-and-try methods for setting and adjusting tools. Co-ordinates at-the-machine problems of presetting, storing, and changing tools. Automatic counters, with or without signal lights, control tool change periods. Applying *human engineering* to shop problems, TOOLITROL eliminates fatigue and prevents costly errors. Standard flush pin and height gages with gage plate, plus the broad line of Scully-Jones "Precision Holding" Tools, give you a completely packaged tool control method. Write for Bulletin 19-50.

New Scully-Jones Drill and Tap Chucks give greater resistance to pull-out . . . improved seating and collet action!

Here's a new twist in drill chuck design that offers many benefits to users and manufacturers of drilling machines. Scully-Jones has discovered how to increase resistance to pull-out, improve seating and collet action, and, in many cases, provide more accurate, concentric chucking. These new Scully-Jones Drill Chucks give you all the advantages of small diameter. Yet, improved 4-slot design provides greater protection against tool breakage and production shutdowns—added assurance that your drills will run true.

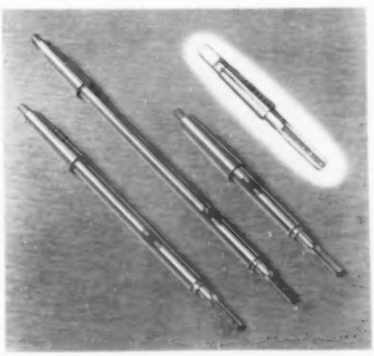
The new 4-slot design is now standard on all sizes ⅛" *and larger*, having normal wall thickness. If chuck wall is thin, design has two short slots and two full-length slots, giving you the same improved chucking with maximum torsional strength. All chucks *up to* ⅛" require conventional 2-slot construction.

All Scully-Jones Drill Chucks are built to withstand heavy punishment, hardened to resist nicking and burring, and designed to outlast many drills.

Check table below for test results showing increased resistance to pull-out provided by this new Scully-Jones Chuck design. Write for Bulletin No. 1-50.

PULL-OUT TEST

Type of Drill Chuck	3/16"	1/4"	23/64"
Two slots	300#	500#	500#
Four slots	1200#	1500#	1400#



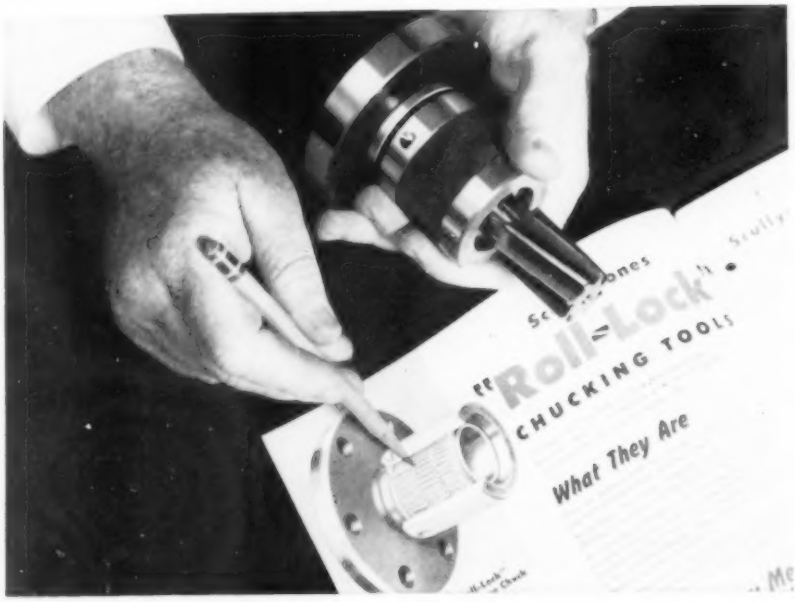
New Close Center Drivers use improved Tap Chuck

These new close center drivers provide greatly increased torsional strength and resistance to pull-out, plus improved seating and collet action. Improved chucks are easier to insert and eject from the drivers, have a broached square for positive drive, and are built sturdier for longer life. Each driver accommodates a range of tap chucks. Start saving now by converting to these improved Scully-Jones Drivers. Write for Bulletin No. 4-50.

SCULLY JONES

Precision Holding News

Scully-Jones expands to give you faster service on powerful and accurate "Roll-Lock" Chucking Tools



Unique operating principle provides accurate, centering shrink fit for chucking parts and tools

No more waiting for overseas shipments or delayed service! With industry acceptance of these great new chucking tools "snowballing" throughout the country, Scully-Jones has added to its plant and facilities, and is now in full production on standard and special "Roll-Lock" Mandrels, Chucks, and Arbors.

The exclusive advantages of "Roll-Lock" tools have been successfully applied for *work* and *tool* holding on countless machining operations, as well as on inspection and gaging equipment. Wherever extreme accuracy and speed of handling are factors, "Roll-Locks" may be the answer to your machining problems. They're a simple and quick method for chucking to a shrink fit, eliminating the drudgery and accessory tools required by conventional methods.

Rigid, powerful holding action of "Roll-Lock" tools permits transmission of torque and thrust necessary for today's fast metal removal. Accurate chucking . . . often within .0001" TIR . . . assures finer finish and fewer rejects. They're a simple, accurate method for locating and chucking pieceparts faster. Actuation and release are simple, too, because operator merely twists the actuating ring or cone (only rolling friction must be overcome) to operate the tool.

Ask your nearby Scully-Jones representative or stocking distributor for recommendations on the use of "Roll-Lock" Chucking Tools for a variety of operations. For complete description of standard and special "Roll-Lock" tools, write for Bulletin No. 17-50.

Standard Flange Type Chuck—turning outside shell (actuating ring) quickly compresses wall of the chuck body evenly along chucking surface, creating a powerful shrink fit.

Flange Type Expanding Arbor—turning actuating cone easily expands wall of arbor body evenly along the chucking surface, eliminating all clearance or play.

Expanding Mandrels—operation is similar to that of expanding arbor, left. Offer unusual accuracy and reduce handling time for testing and measuring operations.

SCULLY JONES

NEED MORE INFORMATION? Call your nearby Scully-Jones representative or stocking distributor—factory-trained precision tool and work holding "specialist"—for information and fast service. To receive "Precision Holding" News regularly, send name, title, and company affiliation.

Scully-Jones and Company

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Form No. 14-54

Printed in

DOWEL PINS

HOW TO USE THEM

1. Precision Dowel Pins are principally used where parts must be accurately positioned and held in absolute relation to one another whether stationary or in motion. They facilitate quick disassembly and completely accurate re-assembly.

2. Allen Dowel Pins are also used as plug gauges.

3. As plugs for determining angular dimensions of dovetail slides.

4. As hinge and wrist pins in applications requiring initial and permanent accuracy.

5. As accurate, economical roller bearings and axles.

6. As guide pins, stops and position locators.

HOW TO JUDGE THEM

1. *On precision, for low tolerance applications.* (Allen Dowel Pins are ground to a maximum microinch finish of 6 RMS protected by a rust preventive.)

2. *On strength, for shear resistance.* (Allen Dowel Pins are made from special Allenoy Steel, heat treated. Single shear strength measures from 160,000 to 180,000 psi.)

3. *On hardness of surface and a core hard enough to prevent "mushrooming" when driven into a tight hole.* (Allen Dowel Pins have a surface hardness of 62-64 Rockwell C Scale and core hardness of 52-54. Average case depth .010 to .020 depending on size.)

The simple sure way to be sure of uniformly superior dowel pin quality is the same as in buying precision socket screws — *get genuine Allens from your Industrial Distributor.* Only he sells them but *we will welcome your direct request for literature or application engineering assistance.*

ALLEN HEAD

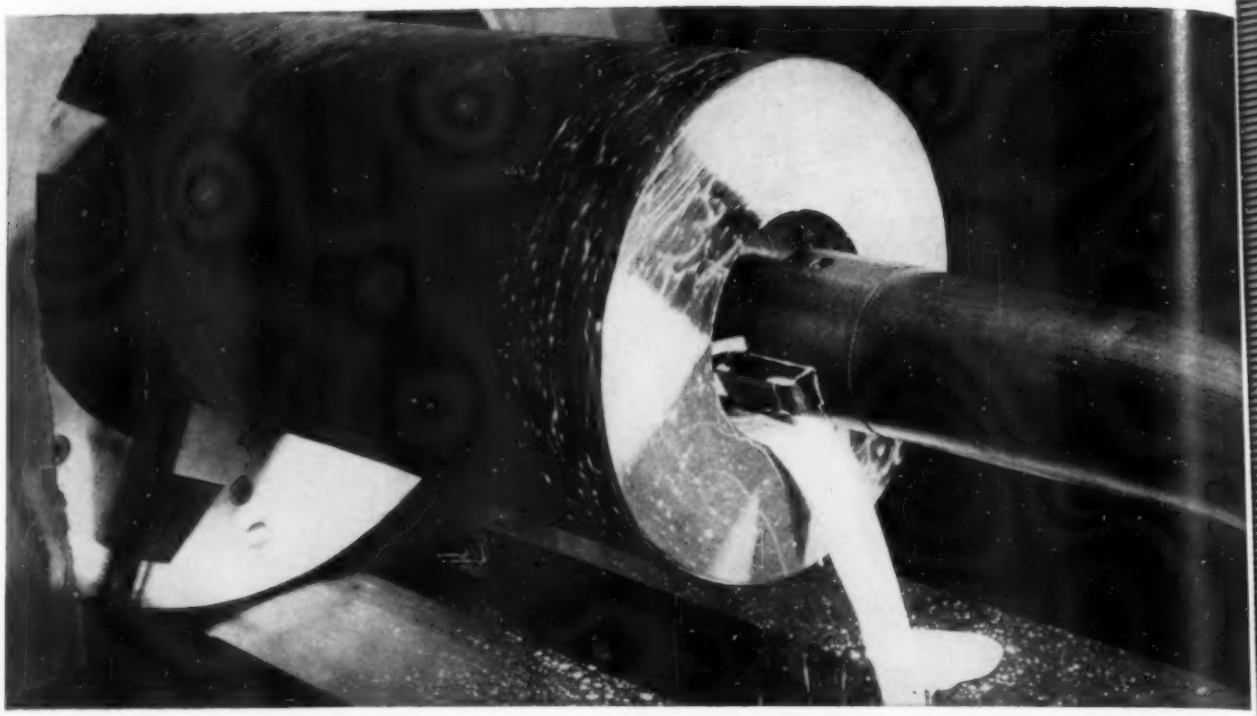
ALLEN

MANUFACTURING COMPANY

Hartford 2, Connecticut U.S.A.

Available in 108 Standard Sizes from ⅛" x ⅜" to 1" x 6". Standard tolerance .0002 oversize. Most sizes also standard in .001 oversize for repair work.

START WITH FINISH BORING!



TIMKEN® seamless steel tubing saves steel, machining time!

FINISH boring is your first production step when you use Timken® seamless steel tubing instead of bar stock for your hollow parts jobs. You don't have to bore out the center hole. With Timken seamless tubing, it's "built-in"! So screw machine stations are available for other jobs. You add machining capacity without adding machines.

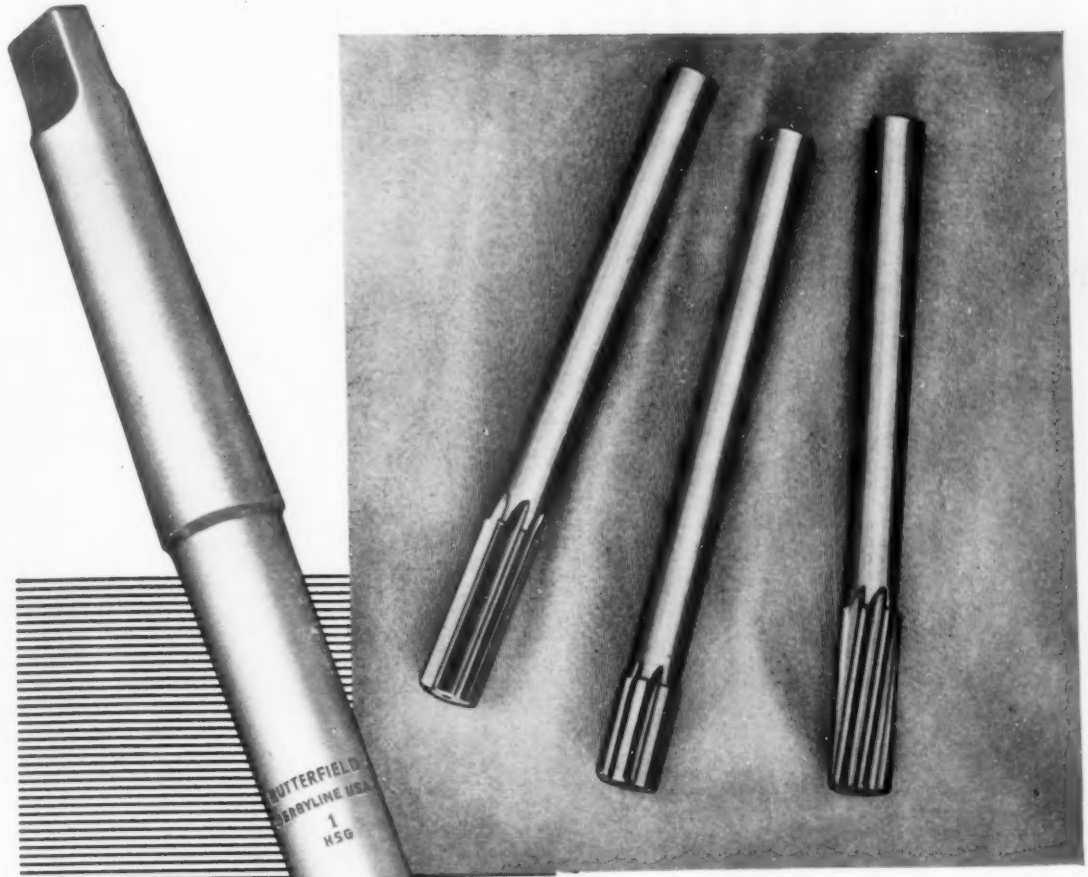
Because the center hole is already there, you also save steel with Timken seamless tubing. There's far less metal to machine away, giving you more parts per ton of steel.

To save you even *more* steel, the Timken Company's engineers will study your problem and recommend the most economical tube size for your hollow parts job—a size guaranteed to clean up to your dimensions.

Timken seamless tubing results in a better quality product, too. The piercing operation by which Timken tubing is made is basically a forging operation. This gives the tubing a uniform spiral grain flow and a refined grain structure that brings out the best in the quality of the metal. And this quality is uniform from tube to tube and heat to heat, due to the Timken Company's rigid quality control. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING



Butterfield's rigid control over quality in every step of its manufacturing process is what gives Butterfield reamers extra performance on your production line.

BUTTERFIELD

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BUTTERFIELD DIVISION
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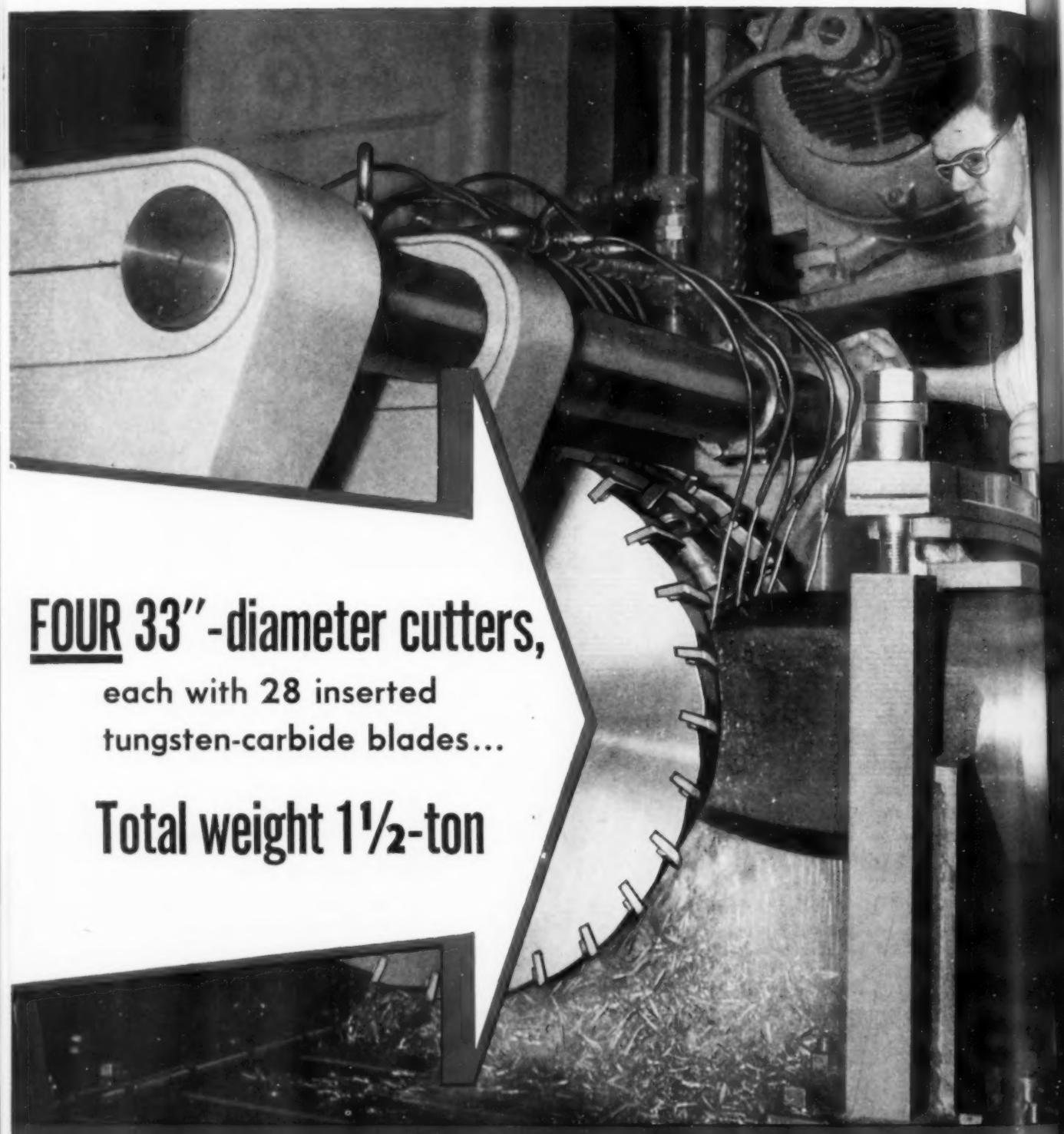
Reducing diet



FOUR 33"-diameter cutters,
each with 28 inserted
tungsten-carbide blades...

Total weight 1½-ton

PRODUCTION DATA

Workpiece: steel forging.
Machine: 4208 Simplex Bed Type milling machine with 50-hp, No. 5 quill type spindle head.
Spindle Speed Range: 6-30 rpm.
Feed Range: ⅛ to 30 ipm.
Cutters: Four . . . 33 in. dia. . . . each with 28 inserted T. C. blades.

for 4-ton forgings

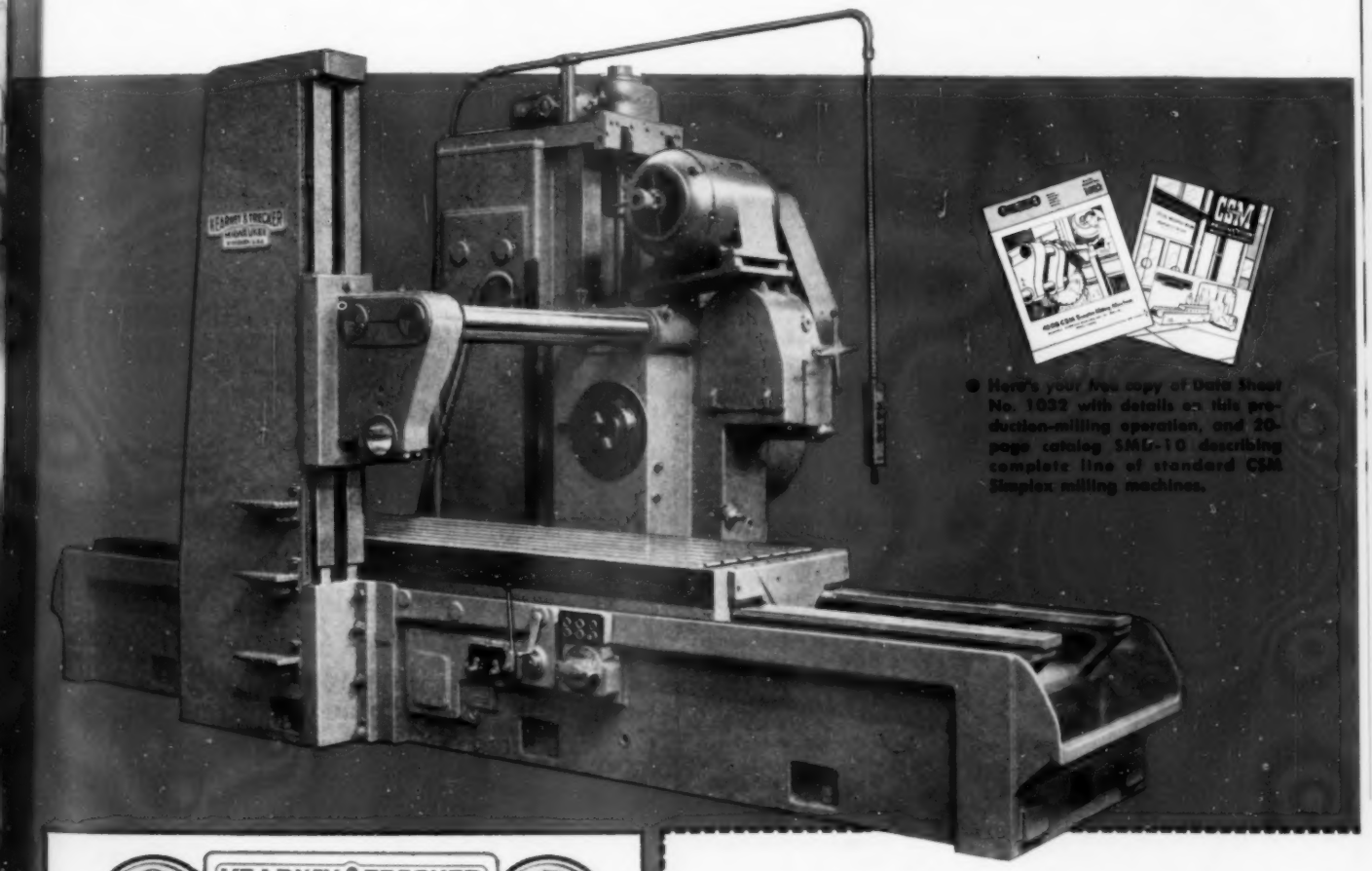
Kearney & Trecker's Bed Type, Model CSM milling machine removes maximum metal with four tungsten-carbide cutters

Here's your answer for increased capacity in the production-milling of large workpieces, like these 4-ton forgings.

It's the Kearney & Trecker 4208 CSM Bed Type Simplex machine. Because of its rugged construction and transmission of maximum power at the cutting tool, it was selected for milling both sides and a middle slot on 4-ton aircraft landing struts.

A special 50-hp quill type spindle head with a low-speed range of 6 to 30 rpm is used to drive four 33" dia. side-milling cutters, each with 28 inserted tungsten-carbide blades. Outstanding machine features include unit construction, combination 30" dia. spindle gear and flywheel, counterweighted head, double overarms for rigid arbor support and independent motor drives for spindle, feed, rapid traverse and coolant pump.

The machine upright, which carries the spindle head is of a full box-section construction with large way surfaces, designed to absorb vibration from the heaviest cutting loads. Rigidity to the large-diameter cutters is also provided by a heavy-duty outer arm brace.



● Here's your free copy of Data Sheet No. 1032 with details on this production-milling operation, and 20-page catalog SMD-10 describing complete line of standard CSM Simplex milling machines.

Special Machinery Division

MILWAUKEE 14, WIS., U.S.A.

KEARNEY & TRECKER CORPORATION, *Special Machinery Division*
6784 W. National Avenue, Milwaukee 14, Wisconsin

Please send me Data Sheet No. 1032 and 20-page catalog SMD-10. ☐ Check here if you would like to have a representative call on you as soon as possible (or call Milwaukee, GReenfield 6-8300).

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

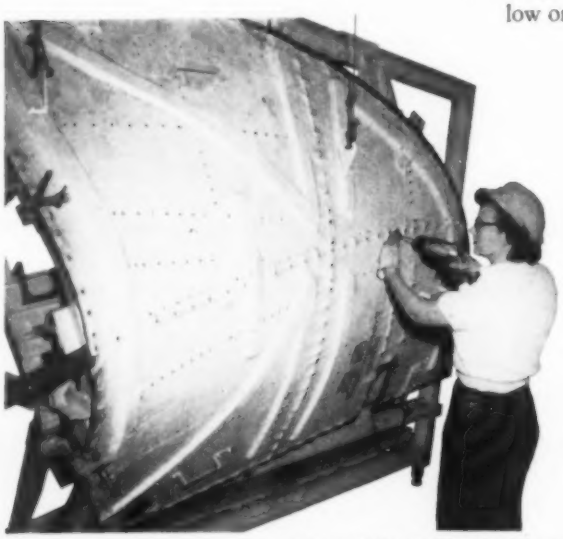
eliminate COSTLY drill fixtures with "laminate plastic" ANCHOR BUSHING drill templates

Laminate plastics and Anchor Bushings are combined to make lightweight drill templates at far less cost and tooling time than required to produce conventional heavy drill fixtures.

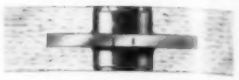
Laminate plastics, formed over wood, metal, clay or plaster and heat or air cured, match any desired size, shape or compound curve. Using hardened steel Anchor Bushings in laminate plastic templates, proper hole coordination is provided for low or high volume production.

Specifically designed for laminate plastics, Anchor Bushings can be imbedded within the plastic material during lay up or rivet attached afterward.

Write for the Anchor Bushing Catalog.



At Douglas Aircraft Company — Long Beach Division, this large laminate plastic Anchor Bushing template is used to drill compound curved fillet for C-124 Globemaster airplane.



One piece Anchor Bushing imbedded in laminate plastic during lay up.

Two piece long pilot Anchor Bushing riveted to finished tool.

Anchor Bushing types, other than shown above, are also available for laminate plastic drill templates.

THE *hi-shear* RIVET TOOL COMPANY

8924 BELLANCA AVENUE • LOS ANGELES 45, CALIFORNIA

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-210-1

More and More Industries are Cutting Costs and Speeding Up Production with...

ROUSSELLE Presses!

It took some concentrated planning, stressing ruggedness and simplicity, along with accurate machining and "close-tolerance" assembly, to bring out these fast, rigid, high output units — THAT COST SO LITTLE — DO SO MUCH — REQUIRE SO LITTLE MAINTENANCE.

In addition to metal forming, bending, shearing, notching, and piercing, they are also adaptable to cutting and punching paper, forming and cutting fibre, plastics, etc.

Often considerable savings are possible if you let our engineering staff assist you. There is no obligation. Simply explain the problem and send sample or drawing of work.

Rousselle Presses are Sold Exclusively through Leading Machinery Dealers and are manufactured by

SERVICE MACHINE CO.

7627-33 S. Ashland Ave. • Chicago 20, Illinois

USE READER SERVICE CARD; INDICATE A-10-210-2

LOOKING FOR THAT COMPLETE ENGINEERING SERVICE?

HERE IT IS!

If you are as over-burdened as this hapless fellow, why not pick a spot where you can set all your packages down with complete confidence? Don't be an industrial juggler, take advantage of the service offered by:

THE COMPLETE ENGINEERING SERVICE

Berg

PLANTS AT
PORT HURON
MARYSVILLE
DETROIT

GENERAL OFFICES

18050 RYAN ROAD, DETROIT 34, MICH. PHONE: FOrest 6-2460

BERG ENGINEERING SERVICE, INC.

PORT HURON MACHINE PRODUCTS CO.

BERG INDUSTRIES, INC.

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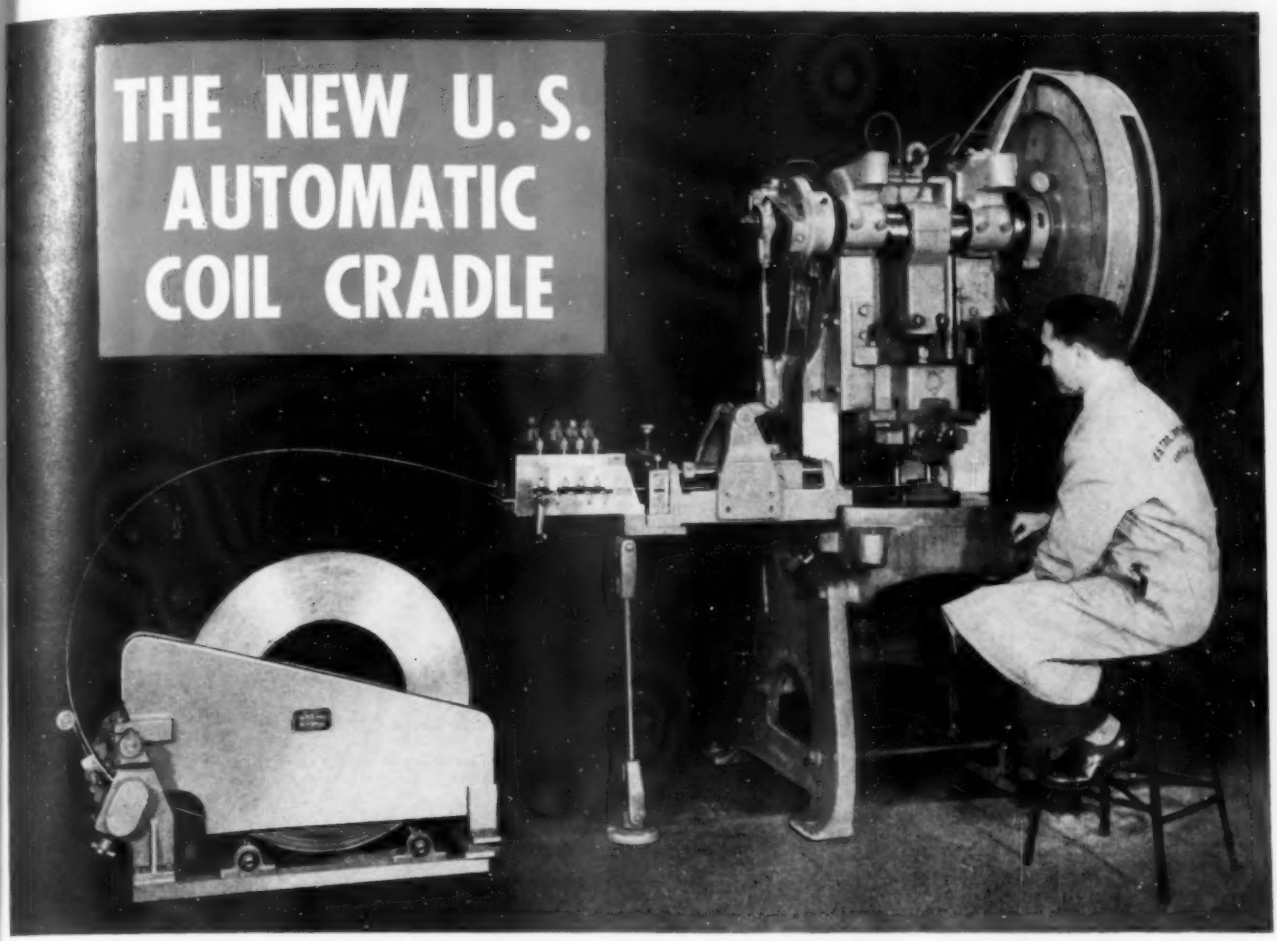


NEWEST PRESS ROOM TIME-SAVER!

If you are interested in obtaining the advantages of automation in your press room, the newest U. S. Automatic Coil Cradle can help make your press room operations faster and more efficient.

This cradle has a capacity for material up to 9 inches wide, in coils with an O.D. up to 40 inches. It is equipped with two coil rest rolls mounted on self-aligning roller bearings. A pair of hardened and ground power-driven take-out rolls unwind the material to the very end of the coil. The ¼ HP geared motor provides output up to 52 feet per minute, and is started and stopped through a mercury switch loop control. Motors can be furnished to provide even higher output if required.

For further time savings, the unit has been designed so that it is a simple matter to place a coil in position without having to raise it to a considerable height, or remove and replace retaining arms, as would be necessary if a stock reel were used.

If you have press room production problems, send for a copy of Bulletin 80-T. From the complete line of U. S. Automatic Press Room Equipment it describes you can find profitable, practical solutions to many of our production problems.

U. S. AUTOMATIC PRESS ROOM EQUIPMENT

- **U. S. Automatic Coil Cradles**
- **U. S. Slide Feeds**
- **U. S. Plain Stock Straighteners**
- **U. S. Power Driven Straighteners**
- **U. S. Scrap Chopper**

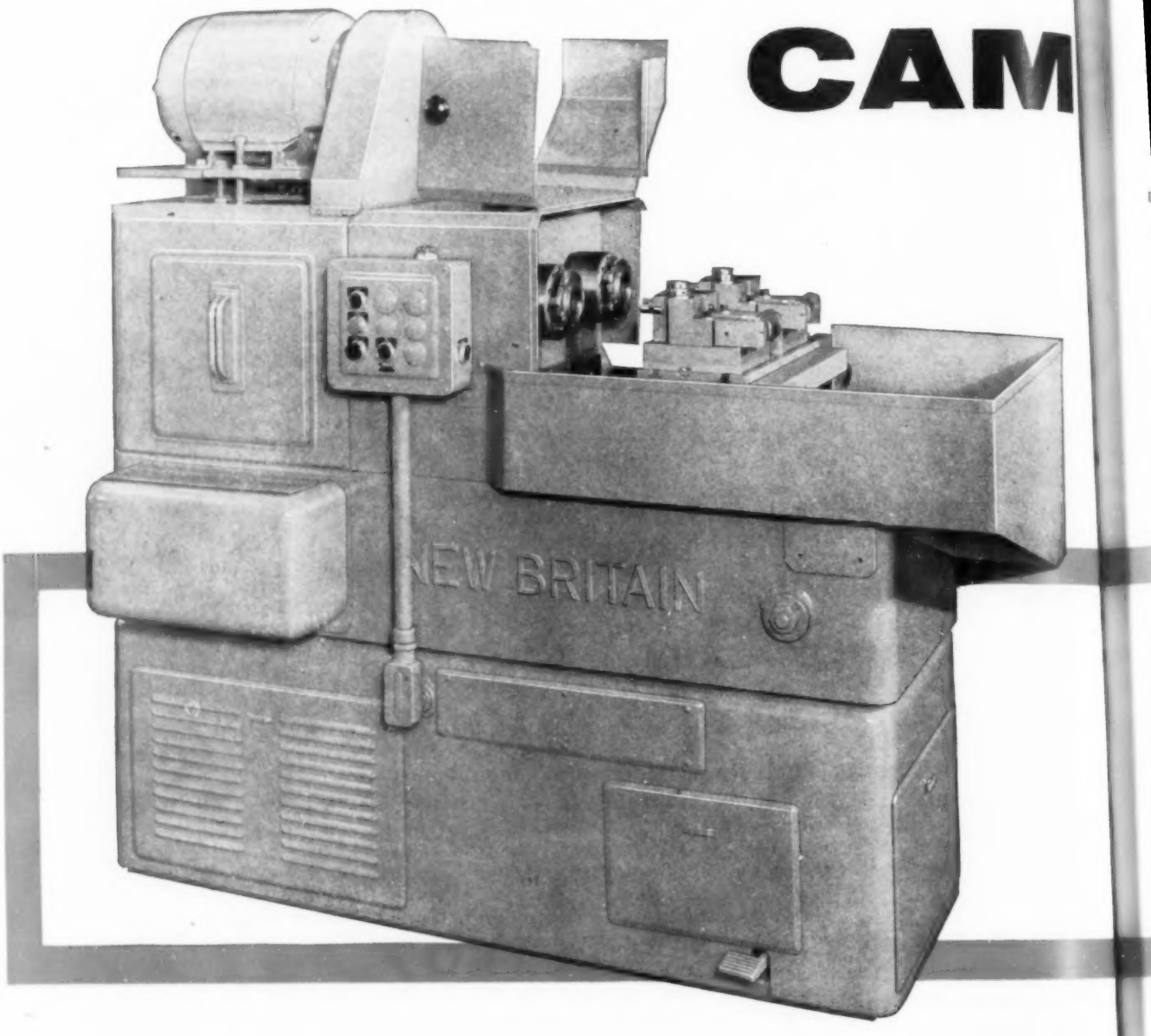
U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides - U. S. Multi-Millers

U. S. Automatic Press Room Equipment - U. S. Die Sets and Accessories

The Advantages of PERMANENTLY CAM



New Britain's exclusive application of cam control (illustrated diagrammatically on the opposite page) gives your tool engineer a completely new approach to tooling for complex pieces. Methods impossible on other types of machines can be employed to speed production and eliminate second operations.

A New Britain precision boring machine will not only turn out a wide variety of work at high speeds, but, because of New Britain's exclusive method of cam actuation, will continue producing them with the same repetitive accuracy — piece after piece, week after week.

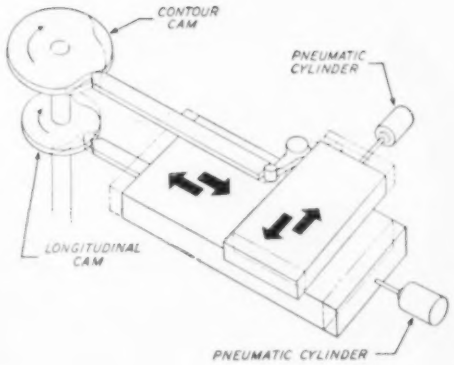
Write for descriptive literature on the New Britain boring machine line, including the details of a variety of specific parts turned out on New Britains.

Cam Actuation....
PRESERVED in New Britain's Precision Boring Machine

Cam shaft, as well as super precision spindles and their motor drive solidly and permanently mounted to frame for continuing accuracy.

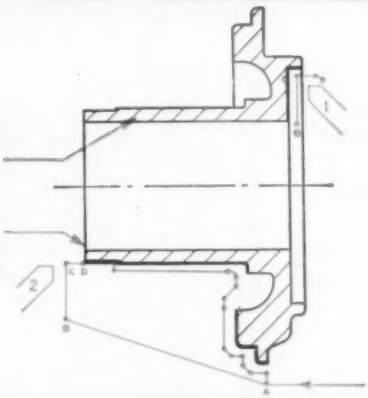
Rugged precision lever transmits cam motion to cross slide.

This exclusive method means simple permanently accurate compound slide motion for an endless variety of single point tool paths.



Expanding arbor chucks piece on I. D.

Back face positively locates against chuck.



With conventional methods, pieces like this present a problem of costly tooling. With New Britain's new approach, tooling this piece is fast, simple and economical with a single chucking and two single point tools.

When you invest in Boring Machines PICK THE MAKE WITH THE EARNED REPUTATION.

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut

Our general catalog is filed in the Sweet's Machine Tool Catalog File.

NEW BRITAIN Automatics NB

Machines for Making Progress

AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES
NEW BRITAIN +GF+ COPYING LATHES

what's so different about

Piercing Color TV Chassis?

Color TV chassis are produced in small lots—require frequent engineering changes—setups and production tools are high cost operations.

THE WIEDEMANN RA-41P TURRET PUNCH PRESS economically produces chassis and panels in small lots for

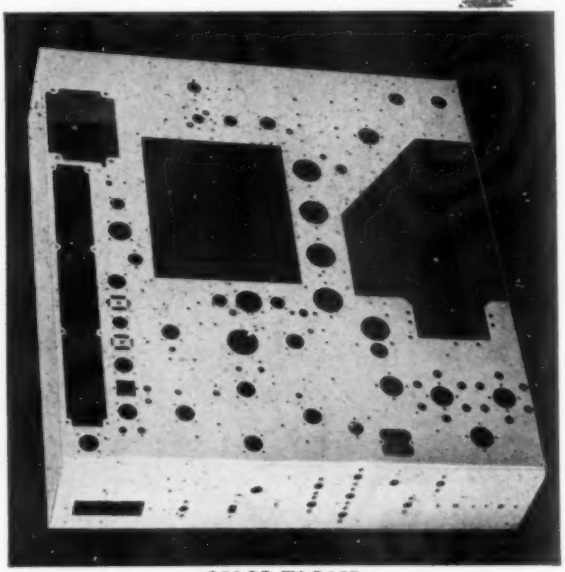
COLOR TV
RADAR
FIRE CONTROL
COMMUNICATIONS
BUSINESS MACHINES
AIRCRAFT

and many other applications

because:

- **Setup time is low**
- **Initial tooling cost is low**
- **Punches and dies are re-used on other jobs so tooling cost soon becomes a negligible factor**
- **Engineering changes are accomplished without delay to production schedules and at low cost**
- **Complete flexibility—close hole centers—20 hole sizes in sheets to 28" x 40" in single handling —40 to 60 holes per minute located to plus or minus .005" tolerance**

These advantages combine to make the RA-41P Wiedemann Turret punch press a paying investment to all chassis fabricators, since the RA-41P is the only machine designed for economically piercing electronic chassis and panels in low runs.



COLOR TV BASE
Quantity 55
(Pierced on Wiedemann RA-41P)
530 strokes of press
31 different punches and dies used
(no special tools)
2 handling operations
TOTAL TIME (floor to floor)
per piece 16.25 MINUTES

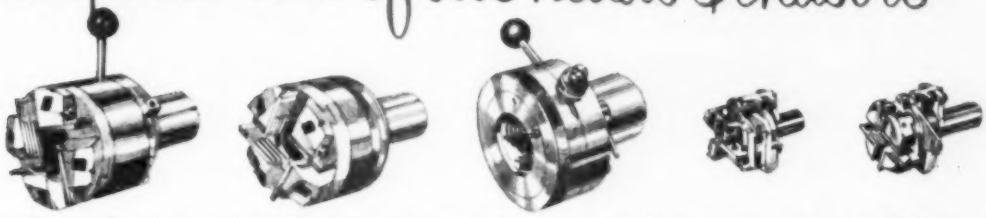
Write for a copy of Bulletin 241

WIEDEMANN MACHINE COMPANY

4245 Wissahickon Avenue, Philadelphia 32, Pa.

Jones & Lamson offers...

a complete line of die heads & chasers

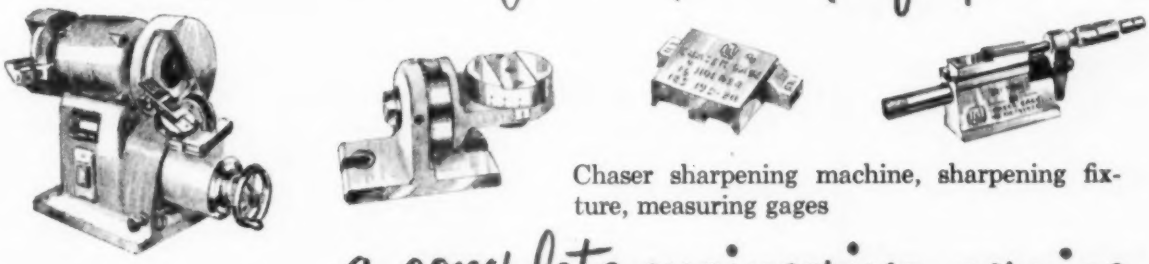


Automatic opening tangent stationary and revolving types, radial stationary type, B&S and small turret lathe types

a complete line of accessories

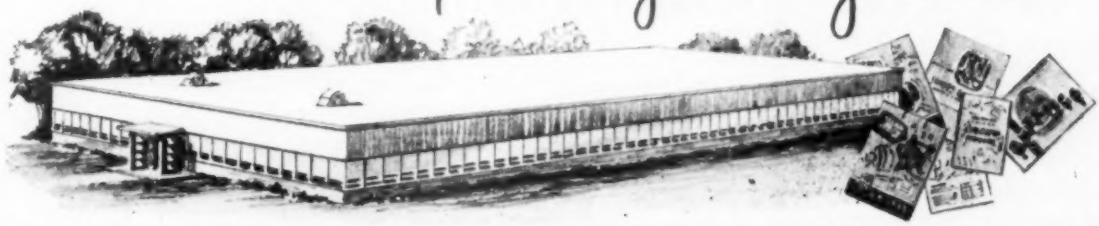
External and internal trip attachments, drill press adapter, floating holders

a complete line of sharpening equipment



Chaser sharpening machine, sharpening fixture, measuring gages

a complete engineering service



World's newest, most modern thread tool plant. Complete literature for all J&L thread tool products

P.S.

J&L Automatic Opening Die Heads and Chasers assure: low initial cost — ease of operation — controlled resharpening — use of carbide where applicable. Class III threads guaranteed. This means important savings regardless of your tolerance requirements. Write to Dept. 710 for complete information.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 518 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L THREAD TOOL DIV.

VK HIGH SPEED STEEL

THREAD MEASURING WIRES

...basic tools in a universally accepted method of checking screw threads

VK Set No. 20 HS Thread Measuring Wires, accurate to ±.000025" for 20 common pitch Unified and American screw threads, 6 to 36 threads per inch.

The three-wire method is probably the best known and most widely accepted system of measuring pitch diameter of screw threads. Equipment required includes only a set of VK Thread Measuring Wires of proper diameter and an accurate measuring instrument.

Van Keuren Thread Measuring Wires have been developed over a period of many years of pioneering in the precise measurement field. They are made to National Bureau of Standards specifications, are held within .00002" for roundness, straightness and identity and to within .000025" of exact size.

VK Threading Measuring Wires are made of long-wearing, tough and beautifully finished high speed steel and are either 1⅞" or 2" in length. Every wire is subjected to the closest criteria in today's standards of accuracy.

In addition to set No. 20, shown here, VK furnishes many other standard sets as well as special wires in diameters from .001" to 1.500."

The Van Keuren Catalog and Handbook No. 35 contains 91 pages of technical and engineering information on wire measurement of screw threads. This information, compiled from many years research in the field, is available without charge by addressing: The Van Keuren Co., 174 Waltham St., Watertown, Mass.

VK

89th YEAR

THE Van Keuren CO.,

174 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires • Chrome Carbide Taper Insert Plug Gages

R and L TAP AND DIE HOLDER

WHEN SECONDS COUNT

The R and L TAP AND DIE HOLDER readily changes from right to left due to the patented instant release action. It can also be adapted to work on short threads, do bottom tapping, or die up to shoulders.

Releasing or non-releasing, (also furnished for acorn dies), this tool is made in a complete range of sizes from ⅝" diameter shank to 1½" diameter shank.

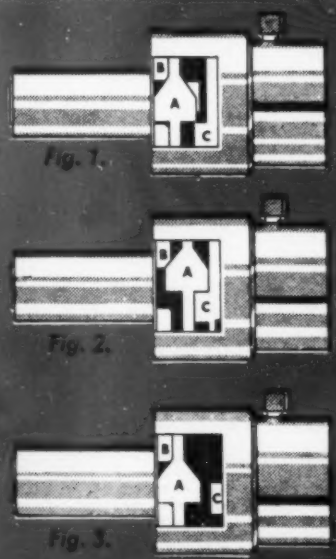


Fig. 1. Ready to start threading operation.

Fig. 2. Instantly engaged to full contact.

Fig. 3. Fully released. Note ample clearance between contact points of clutch.

Write for Catalog

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO AVAILABLE FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-217

"REMOVABLE" TAPER SHANKS for Small Tools

Cut Your Costs with these

Glenzer

UTILITY SLEEVES

You get economy of Straight Shank Tools with Taper Shank Convenience!

They supply removable taper shanks for number, letter, and fractional drill sizes, and other small tools — #1 thru #7 Morse tapers, #7 thru #13 Brown & Sharpe Tapers, and A.S.A. .239, .299, .375, and 4½ tapers.

Standard in leading automobile and many other plants — large and not so large — since 1919.

Send for Circular Index A

THE J. C. GLENZER CO., Inc.
1552 E. NINE MILE ROAD, DETROIT 20, MICH.

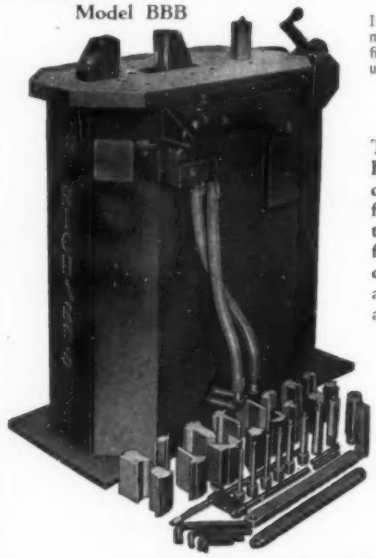
USE READER SERVICE CARD; INDICATE A-10-218-1

Multiform

BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BBB



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅜"x1½" material.

Send for illustrated folder TE-5

903 North Pitcher St.
Kalamazoo, Michigan

J. A. RICHARDS CO.

USE READER SERVICE CARD; INDICATE A-10-218-2

Now...a new principle... a new approach to rapid

DEBURRING and CHAMFERING of inside and outside diameters

NOBUROD and NOBURSINK *High Production Partners!*

Companion tools – NOBURSINK for openly accessible hole faces and NOBUROD for outer ends of rods, tubes and bosses – provide greatly improved work quality, faster and easier than ever before. Both have low torque design permitting rapid, off-hand workpiece handling without chatter – even on large diameters. Unique design allows regrinding without special tools.

Eliminate makeshift and less efficient tools

Both NOBURSINK and NOBUROD tools work equally well on all metals. Cutting chips are freely expelled from the work area. Each tool accommodates a wide range of work size – and are furnished 90° included angle (produces 45° chamfer).

WRITE for FULL DETAILS TODAY!!

NO BUR TOOLS

NOBUR MANUFACTURING CO.

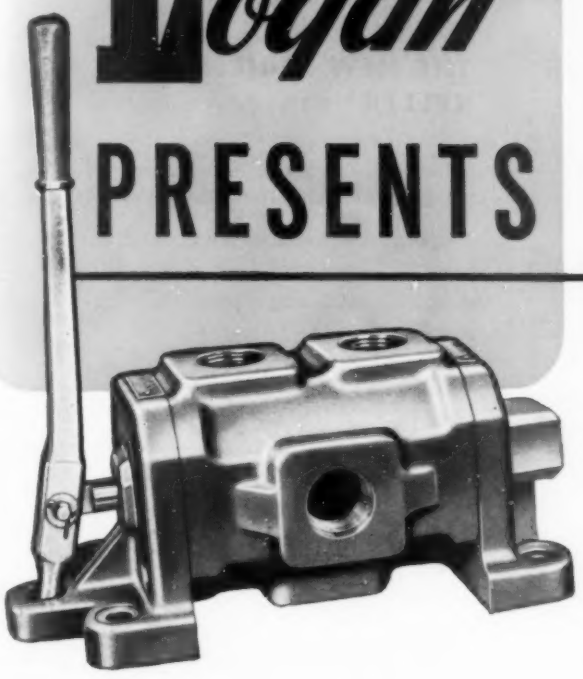
717 No. Victory Boulevard, Burbank, California

USE READER SERVICE CARD; INDICATE A-10-218-3

TO HELP YOU ATTAIN GREATER RODUCTION EFFICIENCY

Logan PRESENTS

New



EIGHT

NEW MODELS IN . . .

HYDRAULIC CONTROL VALVES

WITH

BALL DETENT

FOR POSITION LOCKING

6

NEW MODELS . . . 3-POSITION, 4 WAY

2

NEW MODELS . . . 2-POSITION, 4 AND 3-WAY

Let Logan Engineers Help You Design Your AIR and HYDRAULIC CIRCUITS.

CATALOG SHEETS MAILED PROMPTLY ON REQUEST

LOGAN MANUFACTURERS 7,023 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME Logan AIR AND HYDRAULIC EQUIPMENT EFFORT-MOTION

LOGANSPORT MACHINE CO., INC., 839 CENTER AVE., LOGANSPORT, IND.

Announcing

a completely AUTOMATIC, self-contained, PORTABLE drilling unit with advantages you expect only in expensive machine tools

Peck drilling four deep holes in a magnesium casting

THE NEW SERIES 92A KELLER "AIRFEEDRILL"

—locks to any jig or fixture, and drills accurately. Stationary mounting brackets available

—operates automatically through the complete drilling cycle—advances, drills, retracts, shuts off—at a single pressure of the control valve

—handles peck drilling and skip drilling

—gives complete control over motor speed, drilling speed, torque, rate of advance, and depth of hole

Lightweight and compact—ideal for use in portable or stationary applications

It has these operating features:

SENSING TYPE RAPID ADVANCE brings the drill point quickly to the work, then drops instantly to the drilling rate.

TORQUE CONTROL causes automatic retraction as often as necessary to clear chips during peck drilling. It also protects drills and indicates when they need sharpening.

FEED CONTROL permits adjustment to varying drilling conditions, as well as the material being drilled.

VARIABLE SPEED MOTOR controlled by throttle valve . . . shuts off automatically at end of drilling cycle.

These and other features mean that you can tool up for a few hundred dollars . . . instead of thousands. Send for Catalog Section 92 which fully describes and illustrates this remarkable new tool.

KELLER "Airfeedrill"

SERIES 92A

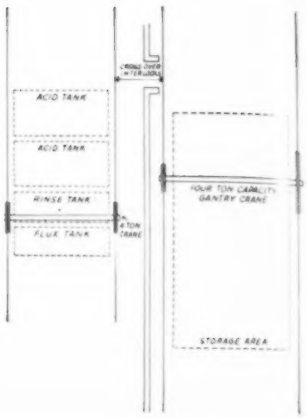
KELLER TOOL COMPANY, 1311 Fulton St., Grand Haven, Mich.

"Yep, Biggest Stock in Town!"

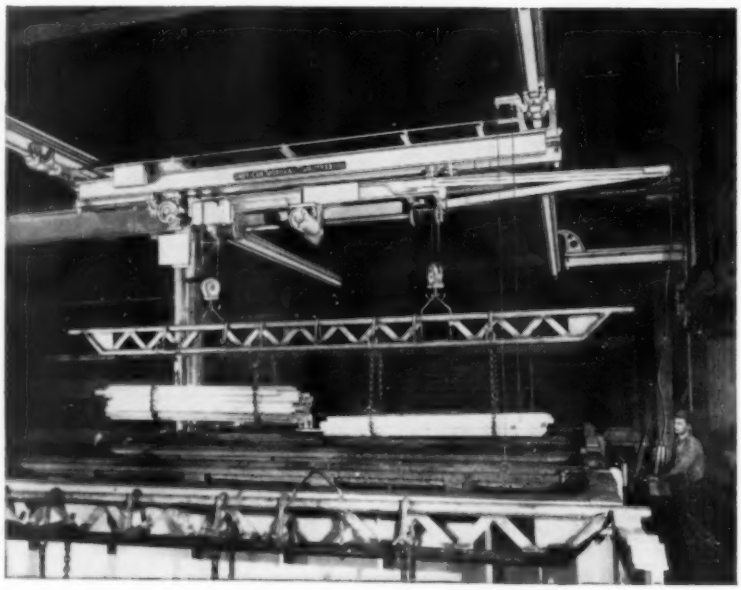
That's what most GREENFIELD Distributors can boast when you ask about threading tools and gages. In fact, chances are that a GREENFIELD Distributor is *The Cutting Tool Center* in your trading area. His knowledge of local demand and of suppliers, his stocks on hand, his ability to give service, all are yours when you buy through a distributor.

Greenfield TAP AND DIE CORPORATION, GREENFIELD, MASSACHUSETTS

Buy taps from DISTRIBUTORS ••• from GREENFIELD DISTRIBUTORS



AMERICAN MONORAIL GANTRY CRANE SYSTEM *speeds galvanizing!*



Steel fence posts travel from fabrication to galvanizing over a gantry bridge which interlocks at a crossover track through doorway for passage to the MonoRail crane serving the tanks in the plating room.

All travel on the 4-ton system is motor operated and controlled by push-button station in the operator's hand.

Here is truly team-work handling that results in cost savings as well as increased tonnage through the galvanizing process. It is a typical example of American MonoRail engineering available at no obligation for the solution of your handling problems.

Send for Bulletin C-1 illustrating hundreds of successful Mono-Rail installations.

AMERICAN OVERHEAD HANDLING EQUIPMENT

MONORAIL COMPANY

13133 ATHENS AVENUE • CLEVELAND 7, OHIO

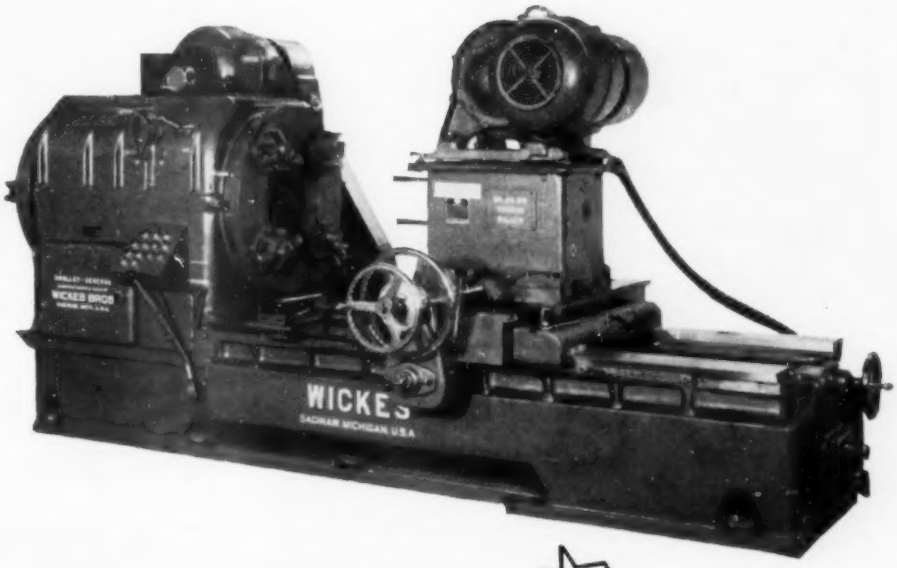
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-222

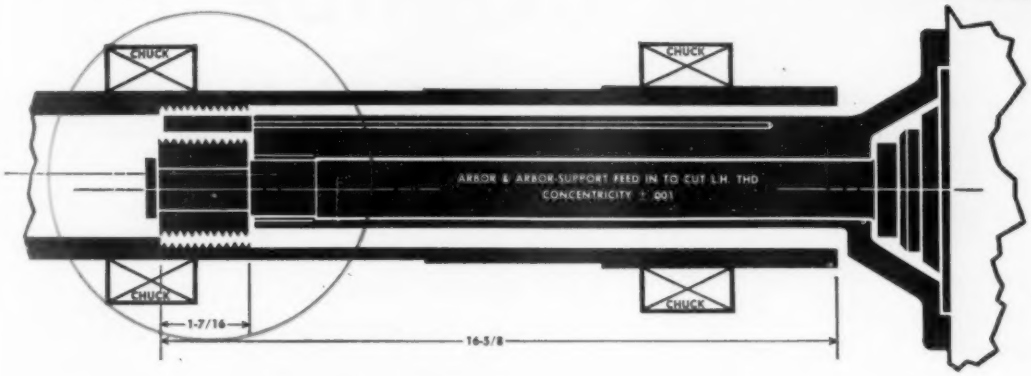
ICKES Smalley General Thread Millers

FORD MOTOR COMPANY

WICKES Smalley General Thread Millers have long been known for their efficient operation. Finish and accuracy obtained eliminate grinding. Efficient on internal or external threads. Note this typical case —

Part: Jet Engine Turbine Shaft
Metal: AMS 6415 Steel heat treated to Rockwell C-35-40
Milling internal thread:
Size 5.3125 — 16 NLH —
P. D. 5.2719 — 5.2785
Thread milling cutter speed:
70 F.P.M.
Work feed: 5 inches per minute
Milling cycle: 5.9 minutes @ 100%





Available WICKES Smalley General Machines:

Size:	#18	#30	#44
Weight:	14,000 lbs.	23,000 lbs.	29,000 lbs.
Capacity:	8¼" hole thru spindle	17" hole thru spindle	18½" hole thru spindle

Send for latest bulletin on any of these machines.

100 YEARS' EXPERIENCE IN SOLVING PRODUCTION PROBLEMS

WICKES BROTHERS · SAGINAW, MICHIGAN

DIVISION OF THE WICKES CORPORATION

83

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-223

NEW *Grip-Tip* CENTERS

CHECK THESE *Grip-Tip* FEATURES

- Long-Life Holders
- Replaceable Carbide Tips
- Easy Insertion and Removal of Male or Female Tips
- Reduced Machine Down-Time
- Lower Cost for Replacement of Carbide Tips
- Carbide Tips Accurate to .0005"
- No Regrinding of Holder
- Carbide Tips Are Easy and Inexpensive to Stock
- Reduced Regrinding Time
- Longer Diamond Wheel Life

with

REPLACEABLE CARBIDE TIPS

Grip-Tip Centers are specifically designed to substantially reduce your replacement costs and machine down-time for regrinding or replacement of worn or chipped centers.

Male or female carbide tips are inserted or removed from the tool steel holders by simply turning a screw. The unique clamping action of holders on tips is positive and quick . . . you save replacement time with Grip-Tip Centers.

The life of Grip-Tip holders is practically unlimited, for, only the dull or chipped carbide tips are reground. Because the steel holder is not ground when sharpening the carbide tip there is less clogging and longer life for your diamond wheels. Also, the relatively inexpensive double end tips in both male and female types can be stocked with a minimum investment . . . Grip-Tip Centers reduce tool and inventory costs.

Grip-Tip Centers increase your production by permitting full utilization of machine tools. It takes but a minute to remove old carbide tip and replace with a new one . . . machine down-time is less with Grip-Tip Centers.

For Further Information, Write to:

DETROIT REAMER & TOOL CO.

2830 EAST SEVEN MILE ROAD • DETROIT 34, MICHIGAN

D R & T COMPANY

HARDENED and GROUND HSS BLANKS

Any decimal diameter to 5/8"—in any length. Mirror finish surface to gage tolerance. Many uses—core pins, punches, gages, ejector pins, insert pins, special tools, etc.—Quick delivery.

Write or phone ORange 3-4301 for price list D-4

William T. Hutchinson Co.
235 Main St., Orange, N. J.

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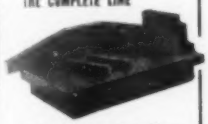
DON'T SCRAPE worn surface plates DON'T SCRAP them either . . . Step them down and continue using them for less accurate work.

THE COMPLETE LINE



Surface Plates • Angle Plates
Straight Edges • Parallels

You'll save enough money to replace with Rahn Diabase for your most accurate work.

It's being done. Many companies have adopted this NO COST way of converting from metal to Rahn Diabase (black granite) Surface Plates.

PROVE IT YOURSELF . . . FREE 30 DAY TRIAL
WRITE FOR BOOKLET ON DETAILS.

RAHN GRANITE SURFACE PLATE CO.
635 N. Western Ave., Dayton 7, O.

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BUILD YOUR OWN SPECIAL MACHINES

At Low Cost . . . to Meet High Production Schedules

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and similar operations

WITH
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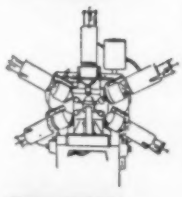
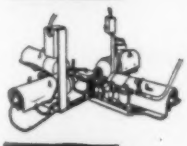
PACKAGED UNITS

NO SPLINES



NO CLUTCHES



NO CAMS

NO REVOLVING WEIGHTS

NO GEARS

Self-contained—operate in any position. Easy to design into special purpose set-ups for single or sequential operations.

Black employs new principle—traversing motor shaft is work spindle. Torque applied uniformly with practically no end play. Air feed advances tool rapidly to work—hydraulic control gives uniform feed to end of work cycle. Tapping unit controlled so tap follows own lead. No chamfering first thread. No stripping on return stroke. Depth accuracy to within .001". Simple adjustments. Wide range of sizes and speeds. Step-drilling controls available.

Write for descriptive literature.

THE BLACK DRILL COMPANY, INC.
1414 East 222nd Street • Cleveland 17, Ohio

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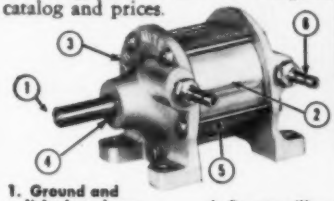
AIR-MITE AIR CYLINDERS

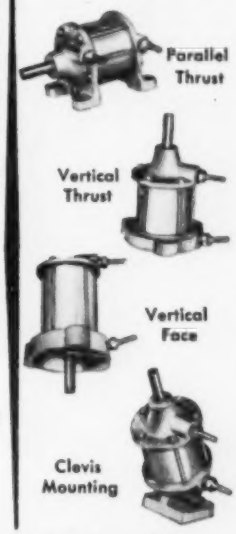
Low Cost . . . Compact . . . Powerful . . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



AIR-MITE Devices, Inc.

4417 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

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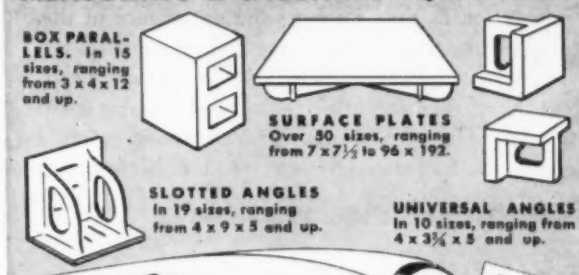
Dependable

MEASURING & CHECKING EQUIPMENT



BOX PARALLELS. In 15 sizes, ranging from 3 x 4 x 12 and up.

SURFACE PLATES Over 30 sizes, ranging from 7 x 7½ to 96 x 192.

SLOTTED ANGLES In 19 sizes, ranging from 4 x 9 x 3 and up.

UNIVERSAL ANGLES In 10 sizes, ranging from 4 x 3¼ x 5 and up.

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HAND WHEELS, KNOBS, HANDLES

Cadmium Plated READY TO DELIVER

Non-rusting — good looking

STRAIGHT and OFFSET TYPE

SOLID ROTARY
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We also build jigs, fixtures, special tools and machinery. Send us your blueprints.

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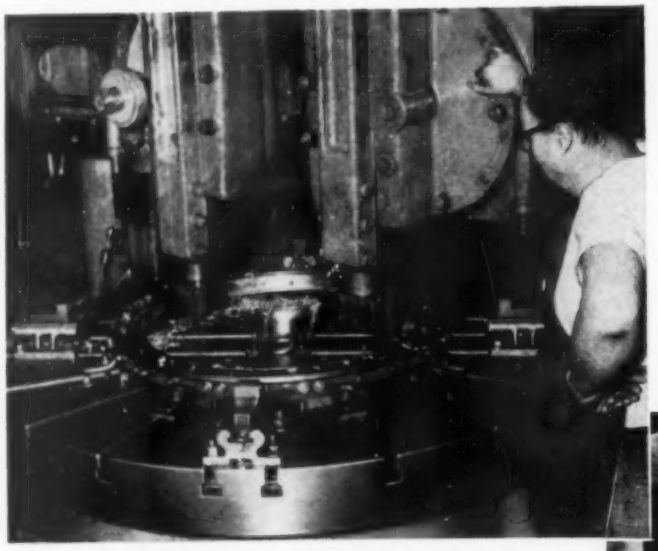
USE READER SERVICE CARD; INDICATE A-10-225-5

Impact Resistance Helped These Jobs PAY OFF



6 TIMES MORE RINGS PER GRIND

HAYNES STELLITE 98M2 alloy tools machine six of these stainless steel rings per grind. They remove 55 cubic inches of metal in 15 minutes while making interrupted cuts across two weld seams, 12 bolted sectors, and 36 bolt holes. Tools previously used failed before one ring was finished. The metal being machined is 321 stainless steel. The depth of cut is ¼ inch, and the speed is 160 revolutions per minute.

40 PER CENT MORE CASTINGS PER GRIND

20 cubic inches of metal per minute are removed from this 18-8 stainless steel casting by HAYNES STELLITE 98M2 alloy tools. The tools make 18 interrupted cuts per revolution as they machine the entire face of this 54 inch casting. Despite the severe operating conditions, HAYNES STELLITE tools turned out 40 per cent more castings per grind than any other tools tested. Cutting speed is 100 surface feet per minute, the depth of cut averaged ¼ in., and the feed is 1/16 in. per revolution. No lubricant was used.

IMPACT RESISTANCE PLUS RED HARDNESS

The ability of HAYNES STELLITE tools to resist impact from intermittent and irregular cuts, chatter, and shock loading, is the main reason they were successful on these jobs. The tools are hard, too, and retain their hardness at red heat. This combination of properties guarantees fast metal removal; makes deep cuts at heavy feeds possible even under the toughest conditions.

A manual on cutting tool practice has been prepared to help you use HAYNES STELLITE tools to advantage. Write to any of our District Offices listed below for your free copy.

HAYNES STELLITE

Trade-Mark

Metal Cutting Tools

The original cobalt-chromium-tungsten metal-cutting tool.

"Haynes Stellite" is a registered trade-mark of Union Carbide and Carbon Corporation.

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Los Angeles — New York — San Francisco — Tulsa

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

this Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation

Keen Edges Hold on Blades of Lehigh H and L

The shear blades shown here are representative of the blades used in pairs in power squaring shears manufactured by Wysong & Miles Company, Greensboro, N. C. The blades are hollow ground, and are made of either Bethlehem Lehigh H or Lehigh L tool steel. They perform economically at speeds up to 60 strokes per minute because they hold their cutting edges for long periods of time, in this way minimizing the need for frequent regrinding.

Lehigh H and Lehigh L are high-carbon, high-chromium tool steels. They form high-chromium carbide concentrations, meaning the ultimate in wear. With its lower carbon content and addition of 1.00 pct nickel, Lehigh L has unusual toughness. It is used for shearing thicker material where shock is involved.

TYPICAL ANALYSES

	C	Cr	Mo	V	Ni
Lehigh H	1.55	11.50	0.80	0.40	—
Lehigh L	0.85	11.50	0.45	0.30	1.00

You can count on good wear-resistance with Lehigh H or Lehigh L. If you would like to have more information about these steels and their use, we suggest that you contact your tool steel distributor, or write direct to us at Bethlehem, Pa.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

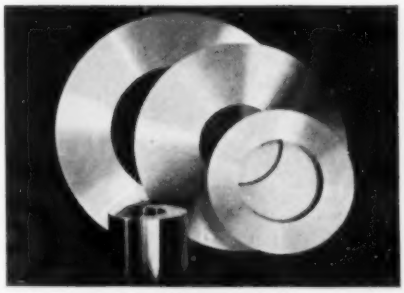
First Harden the Die, Then the Punch

In making up special punch-and-die sets, the fitting of the punch and die after hardening often involves hand grinding or stoning to remove the size changes produced during the hardening operation. The hole in the die will often close in, while the punch will usually expand in diameter. Thus the two parts will not fit, or will lose clearance.

In order to minimize such difficulties, and to reduce tool costs, the use of the following procedure is recommended:

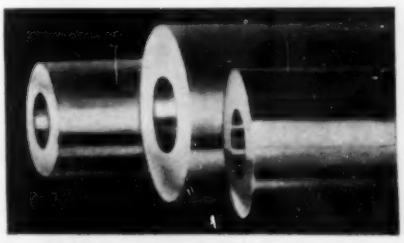
1. Make up the die, and harden it. 2. Make up the soft punch, and fit it to the die. 3. Harden punch. 4. If necessary, fit punch to die by grinding.

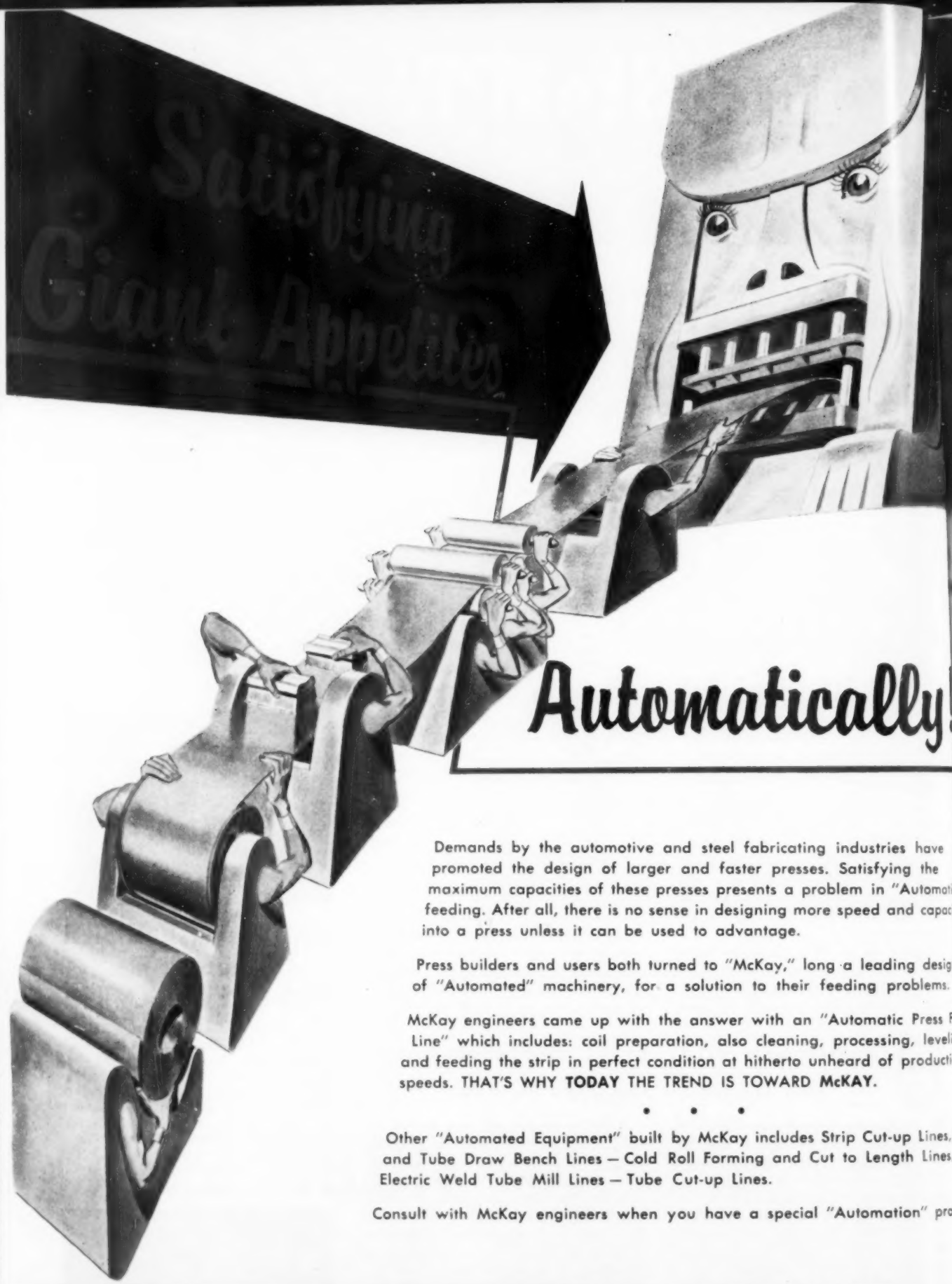
In this way, only one of the two parts is ground in the hardened condition, and the grinding is external and easier than internal grinding. To avoid excessive grinding, it may occasionally be advisable to allow for size-change in the die. But in the main this procedure can bring worthwhile economies.



HOLLOW-BAR TOOL STEEL IS IDEAL FOR RING-TYPE APPLICATIONS

BTR (Bethlehem Tool Room) Hollow-Bar is an excellent steel for hardened bushings, ring dies, draw rings and similar uses *(above)*. It is produced by high-speed trepanning, in which hammer-forged or hot-rolled round bars *(below)* are cored out, followed by rough turning on the outside. Hollow-Bar saves production time, for there's no need to wait for forged rings or discs. Quick delivery, too, for rings can be cut to any length.





Automatically!

Demands by the automotive and steel fabricating industries have promoted the design of larger and faster presses. Satisfying the maximum capacities of these presses presents a problem in "Automatic" feeding. After all, there is no sense in designing more speed and capacity into a press unless it can be used to advantage.

Press builders and users both turned to "McKay," long a leading designer of "Automated" machinery, for a solution to their feeding problems.

McKay engineers came up with the answer with an "Automatic Press Feed Line" which includes: coil preparation, also cleaning, processing, leveling and feeding the strip in perfect condition at hitherto unheard of production speeds. THAT'S WHY **TODAY** THE TREND IS TOWARD **McKAY.**

• • •

Other "Automated Equipment" built by McKay includes Strip Cut-up Lines, Bar and Tube Draw Bench Lines — Cold Roll Forming and Cut to Length Lines, Electric Weld Tube Mill Lines — Tube Cut-up Lines.

Consult with McKay engineers when you have a special "Automation" problem

The McKAY MACHINE Company
YOUNGSTOWN, OHIO

McK

ENGINEERS AND DESIGNERS OF
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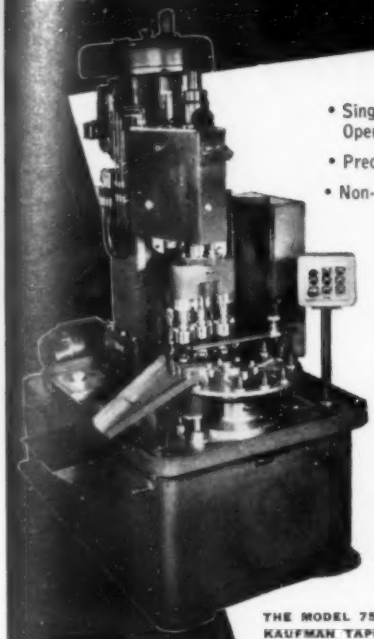
KAUFMAN TAPPING MACHINES

BUILT FOR SPECIFIC PRODUCTION JOBS



- Single or Multiple Head Operation
- Precision Depth Control
- Non-reversing Motor Drives
- Pressure Lubricated Lead Screws
- Fast, Accurate Rugged Index
- Other Head Units Available
- And Many Other, Worthwhile Features

Send prints and sample of your work for further information and recommendations on how Kaufman Tapping Machines can reduce your production costs.

THE MODEL 75-24 KAUFMAN TAPPER

Catalogs Number 754 and 1153 Mailed on request

KAUFMAN

KAUFMAN MANUFACTURING COMPANY
553 S. 29th St. • Manitowoc, Wis.

USE READER SERVICE CARD; INDICATE A-10-229-1

UNCONDITIONALLY GUARANTEED TO . . . .
STOP COOLANT SPLASH!

Lathe Set-Up with Mel-O-Flo Coolant-Aerator No. 600

Mel-O-Flo®
COOLANT AERATOR
PAT. PEND.
FOR SOLUBLE & LIGHT OILS

Connects to the coolant line and mixes atmospheric air with coolant resulting in a non-splash aerated mixture that clings to work and tools. Good for lathe, milling, drilling, grinding, etc.

COOLS & CLINGS BETTER — Aerated Coolant clings better, reduces centrifugal throw-off, has superior wetting action, accelerates heat dissipation; resulting in BETTER COOLING, LONGER TOOL LIFE & INCREASED PRODUCTION.

NON-SPLASH — Aerated Coolant does not splash — keeps operators and floors dry.

NON-CLOGGING — Mel-O-Flo COOLANT AERATOR has a self-cleaning mechanism that provides uninterrupted operation.

SIMPLE INSTALLATION — Mel-O-Flo COOLANT AERATOR connects directly to the coolant line — no compressed air is required.

LOW COST — Model #600 Mel-O-Flo COOLANT-AERATOR With 12" Flexible Hose .....only $17.50
Model #601 Mel-O-Flo COOLANT-AERATOR Less Flexible Hose .....only $14.50

Write for Full Details

Operating Range: 5-60 psi

MELARD Manufacturing Corporation | 433 AUSTIN PLACE NEW YORK 55, N.Y.

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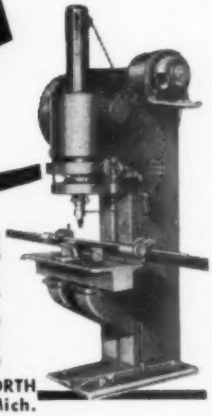
YOU'LL GET MORE PARTS PER HOUR with a . . .

General

FLEXIBLE POWER STRAIGHTENING PRESS



General Manufacturing Co. 6435 FARNSWORTH DETROIT 11, Mich.

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Fellows

MACHINES and TOOLS

FOR CUTTING
. . . SHAVING
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AND INSPECTION
in GEAR PRODUCTION

FELLOWS

THE FELLOWS GEAR SHAPER COMPANY, SPRINGFIELD, VERMONT

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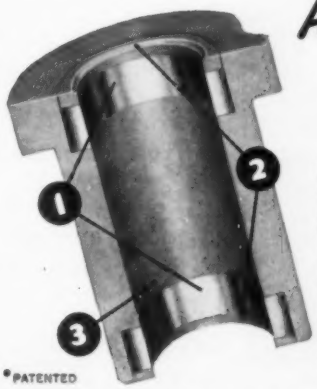
MORE HOLES— MORE ACCURACY— FASTER— AT LESS COST



*PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

For information and prices write for Meyco Bushing Catalog No. 13

MEYCO

Carbide Inserted Bushings Are Doing It Daily!

HOW? Like this: (1) Last longer . . . with a life—in most cases—as long as solid carbide bushings at prices that come close to the prices of ordinary steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man-hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. Don't pass up a good bet! Get the dope on MEYCO Carbide Inserted Drill Jig Bushings today!

W. F. MEYERS CO., INC., BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-10-229-5

NEW Mallory "No-Chat" Tool Shanks

...minimize chatter... permit smoother, deeper cuts

*No-Chat** tool shanks are a completely new idea in machine tool technology. They offer you improvements in tool performance never before possible. The secret is a unique alloy developed by Mallory metallurgical research which has far greater density, rigidity and heat conductivity than steel.

SMOOTHER FINISHES, HEAVIER CUTS. *No-Chat* shanks are twice as dense and 75% more rigid than steel. On identical cuts, they reduce chatter by as much as 50% (see test pictures below). The smoother cuts you get may let you eliminate finish grinding . . . remove more stock per cut!

TOOLS LAST LONGER. *No-Chat* shanks conduct heat away from the cutting tip *three times faster* than steel. Because tools run cooler and vibrate less, they last longer between grinds. Expansion of the *No-Chat* shank closely matches that of the carbide tip . . . brazed joint is more permanent.

TIP ASSEMBLY IS EASIER. The non-annealing characteristic of this alloy eliminates problems of grain growth in brazing or welding. Excellent brazed joints between tip and shank can be obtained with a wide variety of brazing alloys.

SHANKS ARE RE-USABLE. New tips are readily brazed to the *No-Chat* shank.

Plan now to take advantage of this important development in the tools you manufacture or purchase. For complete data, write today for our new Technical Bulletin.

TESTS PROVE HOW *NO-CHAT* REDUCES CHATTER

These oscillograms show the greatly reduced amplitude of tool vibration with *No-Chat* shanks, using identical machine set-ups, when taking a 0.030" cut in low carbon cold rolled steel at 450 SFPM.

With ½" steel shank and style C-8 bit.

With ½" *No-Chat* shank and style C-8 bit.

Expect more . . .

Get more from MALLORY

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P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

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...VERSATILITY
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More for your money in the new U. S. VERTICAL MILLING MACHINE!

U. S. Vertical's balanced rigidity is the key to profitable production. Make the same comparison made by hundreds of plants. See why they find the U. S. Vertical to be the low-cost mill they demand. New "U. S." features include hard chrome plated quill, precision honed head and overarm bosses; and a quick change collet draw bar. Write today for complete details.

The U. S. Burke Machine Tool Division,
16 Brotherton Road,
Cincinnati 27, Ohio.

***Accuracy Certified!** Check list showing results of actual inspection tests accompanies each machine.

Compare

FEATURES

- Balanced head and motor
- Simplified belt-speed changing
- Conveniently located reversing switch
- Protected knee gearing
- Lubricated-sealed ball bearings
- Built-in spot light
- Swing-out Tool-Keeper
- Guaranteed close tolerances*
- Hardened and ground lead screws (optional)

Compare

SPECIFICATIONS

	U. S. VERTICAL
Table Size	9½" x 36"
Longitudinal Feed	24"
Cross Feed	9¾"
Knee Travel	16½"
Quill Travel	5½"
Dovetail Depth	1¼" x 1½"
Vertical Screw	1⅜" dia.
Weight	1600 lbs.
Table Power Feed	0" - 12" per min. (infinitely variable)

CHECK THESE AGAINST ALL COMPETITION!

Compare

DELIVERY, too!

. . . our new plant addition permits us to promise and fulfill prompt deliveries.

THE U·S·Burke MACHINE TOOL DIVISION

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...and REX is the original high speed steel by which all others are judged

Great works of art clearly show the unique skills of their maker. Even the most careful copy can never truly duplicate the original.

Crucible REX® High Speed Steels are *originals*, too. Ever since 1900, when the Country's leading tool steel specialists combined their knowledge and formed Crucible, we have lavished on tool steel making all the skill and care that goes into any work of art.

That's why REX is the standard of comparison wherever high speed steels are used. But see for yourself. Put REX to work in your shop . . . check its hardenability, response to heat treatment, general quality and fine tool performance. We feel sure that, like thousands of others, you'll come back for more.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-232

Where PERFORMANCE

...and PRICE Meet!

Modern tool and cutter grinding demands top performance *and* economy.

BAY STATE'S new "8A" vitrified Bonded Wheels meet both these requirements.

FIRST

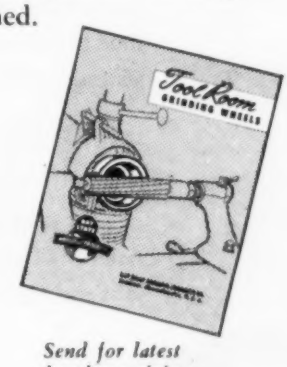
"8A" is a combination of specially selected and blended abrasives.

Result: Wheel cost is considerably lower, yet the all-important cutting characteristics of premium priced wheels are matched.

SECOND

The cutting action is fast, free, and cool . . . giving long useful life with minimum dressing.

This is one more illustration of "better grinding" engineered by BAY STATE in its outstanding "Wheels of Progress" program.



Send for latest brochure giving tool grinding specifications.

BAY STATE
WHEELS of PROGRESS

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass., U. S. A.

Branch Offices and Warehouses — Chicago, Cleveland, Detroit, Pittsburgh
Distributors — All principal cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

Manufacturers of all types of Quality Abrasive Products

Everything Stops— If One Tap Fails!

Play Safe

Specify

BESLY TAPS

You don't take a chance when you use Besly Taps in your multiple tapping operations because you can be sure of uniform threads and long, dependable tap life. There's less expensive down-time to change taps; material and labor isn't wasted because holes are being improperly tapped.

LET US PROVE TO YOU . . .

that Besly Taps can give you better tapped holes . . . for a longer time on *any* tapping operation. Ask for a free TRIAL RUN on your toughest jobs and see for yourself what Besly Taps can do.

UNSURPASSED ACCURACY AT ALL VITAL POINTS

- Microcentric CHAMFER
- Accurate RAKE ANGLE
- Solid-Ground THREAD FORM
- Mirror-finish FLUTES
- Tru-Square DRIVER

BESLY-WELLES CORPORATION

Established as Charles H. Besly & Co. in 1875
118 Dearborn Ave., Beloit, Wisconsin

TAP TIPS The handy "Handbook for Tap Users" is full of information on tapping methods and tap selection. WRITE FOR YOUR FREE COPY.

BESLY Drills, Reamers and End Mills—High-Speed Cutting Tools in a complete range of types and sizes.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-234

The precise pitch of this wire helix, in its glass tube, is accurately measured by Hewlett-Packard Company, using a Kodak Contour Projector.

to make the difficult easy

...the easy economical

Using the same contour projector, Hewlett-Packard checks spacing and parallelism of this special tuning condenser.

Hewlett-Packard relies on the Kodak Contour Projector

Here is an on-the-job demonstration of how projection gaging can solve difficult problems in inspection, slash costs in checking parts to close tolerances.

Using a Kodak Contour Projector, Hewlett-Packard Company measures the pitch of a precision-wire helix for a unique electronic tube. Surface and shadow illumination provide a 20× enlarged image of the minute and delicate part. "Without the Kodak Contour Projector," say Hewlett-Packard officials, "it would not be practical to make the measurements necessary to get a satisfactory instrument."

Using the same contour projector, Hewlett-Packard also checks spacing and parallelism of a special tuning condenser for electronic test equipment. Conventional shadow projection provides a 10× enlarged image of the leaves. "Use of the projector," the company reports, "permits economical measurements of parallelism to an accuracy impossible to obtain by other methods."

Diverse jobs like this are easily done with a Kodak Contour Projector. A twist of a dial provides whatever magnification is needed. A flick of a switch brings surface illumination to supplement shadow projection. Easy to see, isn't it, how a Kodak Contour Projector quickly pays for itself in use.

For more information on how you can use projection gaging in your own work, send for a free copy of "Kodak Contour Projectors."

EASTMAN KODAK COMPANY
Special Products Sales Division
Rochester 4, N. Y.

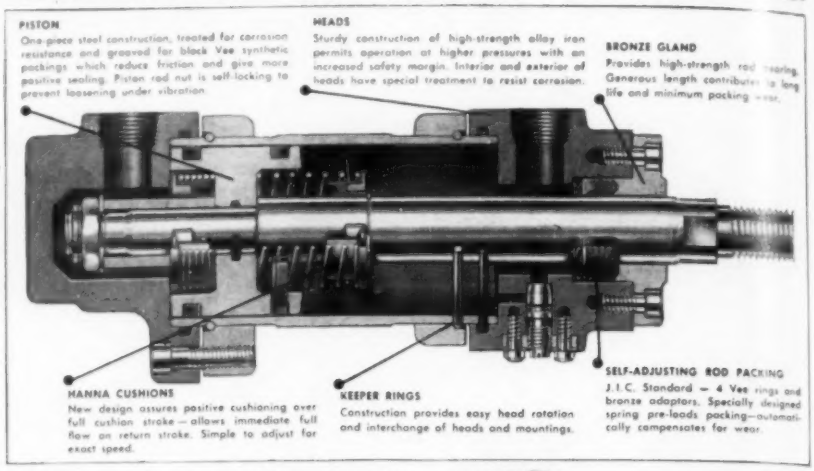
the KODAK CONTOUR PROJECTOR

Kodak

Completely New in DESIGN and ENGINEERING

HANNA *Fluid Power* 750 SERIES

CYLINDERS


PISTON
One-piece steel construction, treated for corrosion resistance and grooved for black Vee synthetic packings which reduce friction and give more positive sealing. Piston rod nut is self-locking to prevent loosening under vibration.
HEADS
Sturdy construction of high-strength alloy iron permits operation at higher pressures with an increased safety margin. Interior and exterior of heads have special treatment to resist corrosion.
BRONZE GLAND
Provides high-strength rod bearing. Generous length contributes to long life and minimum packing wear.
HANNA CUSHIONS
New design assures positive cushioning over full cushion stroke — allows immediate full flow on return stroke. Simple to adjust for exact speed.
KEEPER RINGS
Construction provides easy head rotation and interchange of heads and mountings.
SELF-ADJUSTING ROD PACKING
J.I.C. Standard — 4 Vee rings and bronze adaptors. Specially designed spring pre-loads packing—automatically compensates for wear.

■ We didn't design these cylinders with a "new look" in mind — although they have it. What's most important to you is their new performance . . . new operating features . . . new versatility. The cross-section points out just some of the new features. Others are: ground, polished, chrome-plated rods of alloy steel; cold drawn brass cylinder tubes; cushion adjustment dials; large fluid passages; and J.I.C. Standard leak-proof "O" ring gaskets.

You will like the greater power developed from dimensionally smaller units in the Hanna "750" Fluid Power line. Because of their broad capacity range, air up to 250 psi and hydraulic up to 750 psi, you'll be sure of smooth, dependable and lasting operation in the medium pressure ranges.

Inside and outside, Hanna "750" Fluid Power Cylinders are truly new. Together with their proved companions, Hanna LP and Hanna HP Cylinders, they offer a complete range of capacities, sizes and mounting styles to suit your requirements. For details, ask your Hanna Representative (see your classified telephone directory), or write for the new Catalog. No obligation.

Hanna Engineering Works
1768 Elston Avenue - Chicago 22, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-236-1

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TOOLS
BLADES
ROLLS
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Many times more durable than steel, Talide Metal adds years of life to the wearing edges of tools, dies, machinery and equipment.
Hard as a diamond and almost indestructible, it triples output per man and per machine.
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Here's a New
"PACKAGE DEAL"
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DRILL BUSHINGS
Never before
has there been a DRILL BUSHING that offered SO MUCH FOR SO LITTLE
Check these exclusive ACE "Plus-Factors"
HIGHEST QUALITY STEELS
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LARGER AVAILABLE STOCKS IN PRINCIPLE AREAS.
Yes, these are all part of the new "Package Deal" you get every time you "Specify ACE!"—
"Industry's First Choice in Drill Bushings"
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BEVEL GEAR ACCURACY

- low-cost tooling
- simplicity of set-up

NO. 120 MIKRON

fine pitch

BEVEL GEAR HOBBING MACHINE

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

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Reduce Broaching Costs
ON SMALL JOBS

OIL GROOVES
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SMALL SPLINES
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KEYWAYS
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SLOTTING
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BURRING
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SIZING HOLES

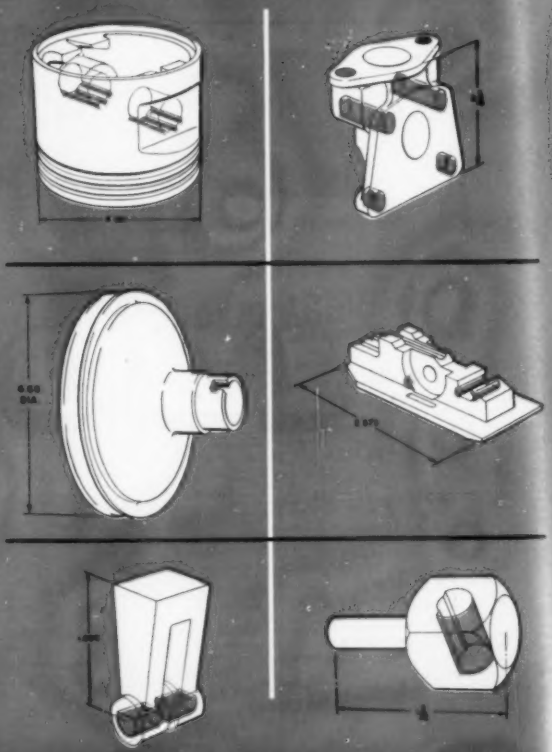
Here is your opportunity to reduce machine time and cut production costs on those small broaching jobs. And you avoid tying up your regular broaching machines which are built for heavier work.

The Red Ring Self-contained Broaching Fixture is a compact, portable, bench-type unit. Specifically designed for a particular job, it has all the elements (automatic and manual) of any well designed fixture. A pneumatic cylinder is added to pull or push the broach. Just connect it with the air supply and you are ready to start broaching.

These Red Ring Fixtures are used on a wide range of small jobs requiring a "Pull" not to exceed 2000 lbs. and a stroke of 25" or less. Here they are highly effective and very economical.

Investigate—talk with a Red Ring Engineer or write for Bulletin B54-9.

6978



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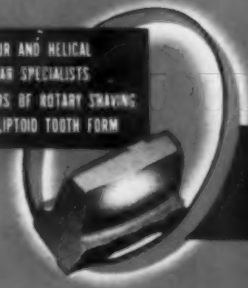
GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM



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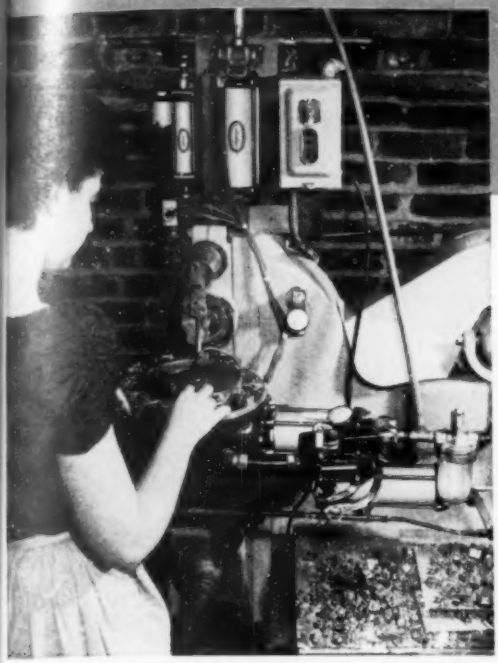
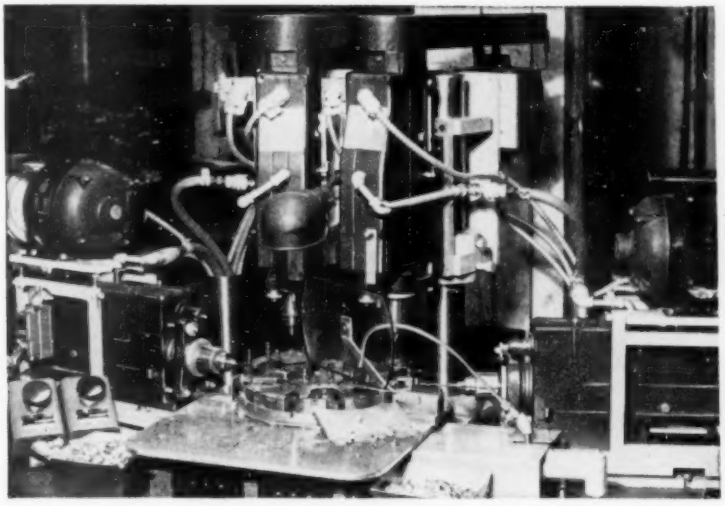
WITH THIS UNIQUE AIR MOTOR

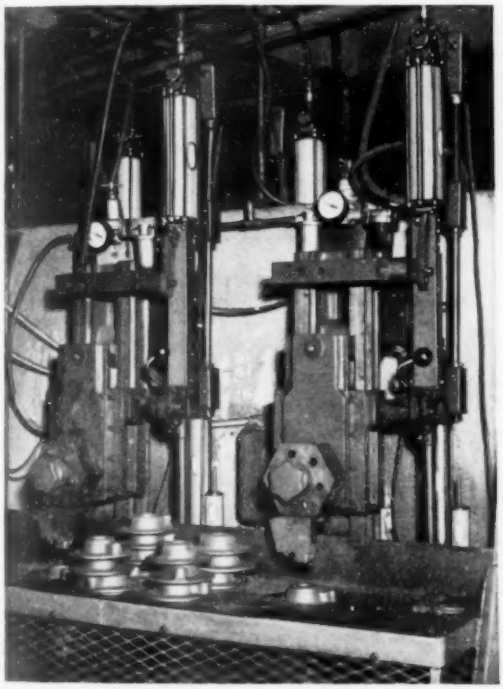
you can build cost-cutting special machines or modernize existing machines right in your own shop with your own personnel



This semi-automatic set-up at Eastman Manufacturing Co. doubled production and eliminated fatigue in milling bakelite magneto parts.



This drilling machine, built by Horrocks-Ibbotson, turned out 1 year's production of their fishing reel pawl blocks in 3 months.



A simple installation cut lathe time on steel ordnance parts from 90 to 10 seconds per piece at Joseph Pickard's Sons of Philadelphia.

Even for short runs you'll find special machines built around this versatile power unit will pay off in a big way — in greatly lowered costs, in fewer rejects, in better product quality. No expensive engineering is needed. In fact, your local Bellows Field Engineer may have in his Foto-Facts File basic designs that can be readily adapted to your product and your production processes.

Your own tool room can build such special machines at decidedly low cost, and quickly. Often they pay for themselves with the first week's savings.

The Bellows Co.

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Bulletin CL-50 tells the story of the Bellows Air Motor and the part it is playing in cutting manufacturing costs in hundreds of plants.
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917-A

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50 years-

fine saw steels

by JESSOP

The name Jessop has been synonymous with fine quality steels for 170 years. Jessop metallurgists and production men pioneered many "firsts" in the specialty steel field. For instance, 53 years ago Jessop became the first producer of quality saw steels in the United States. Today, Jessop is making further strides in this field. It is one of very few domestic sources for periphery-rolled saw steel circles and ground and tempered steels for the manufacture of saws. There are several reasons for the consistent high quality of Jessop's saw steels. First of all, Jessop rigidly controls its melting formulas and pours ingots small enough for cross rolling. This assures a fine, uniform grain structure so that the stock blanks well, forms well, swages well, and has superior edge-holding properties. Moreover, though Jessop's tradition dates back to 1784, it is today a young, revitalized organization aggressively building new business on value received. The new Jessop team will give you better service and better delivery than you can expect elsewhere. Send in an order and find out how good this saw steel is.

JESSOP

STEEL COMPANY · WASHINGTON, PA.

Motorists: here's proof...

Gulf's cleaner-burning, super-refined gasoline solves today's No. 1 engine problem!

This lamp is burning the "DIRTY-BURNING TAIL-END" of gasoline which GULF refines out
This lamp is burning NEW SUPER-REFINED GULF NO-NOX, the cleaner-burning super-fuel

Laboratory tests promised...

. . . these *immediate* and *lasting* benefits from this new, super-refined fuel:

More complete engine protection than from the so-called "miracle-additive" gasolines. Why? Because Gulf refines *out* the "dirty-burning tail-end" of gasoline (the No. 1 troublemaker in high-compression engines)—and then treats this new Super-Refined NO-NOX to give it a *complete range of protective properties*. It protects *every* part it touches against carbon, rust, gum.

Extra gas mileage in all your everyday, short-trip, stop-and-go driving.

No knock, no pre-ignition. Why? Because the anti-knock power of new Gulf NO-NOX has been stepped up to an all-time high.

Stall-proof smoothness. Instant *starts*, too—and fast, fuel-saving warm-up.

That's why new Super-Refined Gulf NO-NOX gives your engine more power-with-protection than you've ever known.

Road tests proved...

These cars, powered by New Gulf No-Nox, actually performed better than new . . . after 15,000 miles!

True! After 15,000 miles per car—covering all conditions of city and country driving—Gulf test cars showed these results:

- Higher-than-new horsepower!
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- And not a single trace of carbon knock or pre-ignition at any time—even on the steepest mountain grades!

GULF

COMPLETELY NEW! SUPER-REFINED

New Gulf No-Nox

THE HIGH-EFFICIENCY GASOLINE

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reduce that part cost . . .

BROACH IT the *American* way

Broaching is a metal-cutting process that will remove stock to precision limits faster than any other metal-cutting process known — and will maintain those precision limits throughout production runs.

Below are a few jobs that have been done with American broaching tools and machines.

Broach and burnish round holes in refrigerator hub parts.

Broach splines and hole in automobile bevel gear.

Broach seven external slots in pump rotor part.

Broach jig pads and bolt seats on automotive connecting rods and caps.

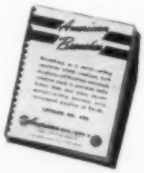
Broach involute teeth and cam surface of gear part.

Regardless of how simple or complex your broaching application may be, American can furnish you broaching tools to meet your requirements in part tolerance and finish.

In addition to making all types of broaching tools, American builds broaching machines and fixtures, giving you a well-rounded manufacturing service. American backs up its products with a strong service organization that makes certain broaches, fixtures and machines installed by American will do the job for you.

So why not let American help solve your machining problems. Just send a part print or sample for a free estimate.

Write for Catalog 450. It describes American broaches, machines and fixtures.



AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

Miller AIR CYLINDERS

In "Custom-Built" and "Stock" Models

Immediate Delivery on "Stock" Models!

Take your choice! . . . Get Miller quality-famous "Custom-Built" Air Cylinders available on normal, scheduled delivery in an *infinite selection* of bore-and-stroke combinations in 14 standard mountings . . .

. . . Or get identical quality "Stock" Miller Air Cylinders *ready for immediate shipment to you* in these popular sizes, strokes and mountings . . .

NON-CUSHIONED: 2", 2½", 4", and 6" bore sizes, each available in 2", 4", 6", 8" and 11" stroke lengths.

CUSHIONED BOTH ENDS: 2", 3¼", 5" and 8" bore sizes, each available in 3", 5", 7", 9" and 13" stroke lengths.

"Stock" Cylinders are base Model A53 with foot, flange, and pivot mounting attachments available as desired.

NOTE: Additional sizes are being added daily, considerably augmenting the above list. Stock Hydraulic Cylinders also available.

Write For Complete "Stock" List

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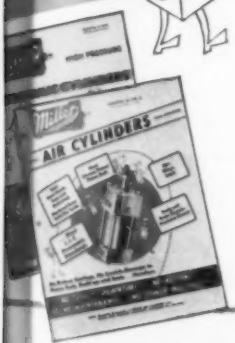
Scratch-Damage, Rust

IRT WIPER SEALS
Protect Rods, Seals, Bushings

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

BRASS BARRELS
Eliminate Rust and Corrosion



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Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

MET J. I. C. PNEUMATI STANDARDS years befor their adoption in 1950.

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AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATOR
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In the 1860's, a hundred courageous riders and over 400 mounts, kept the Pony Express open from St. Louis to San Francisco, through sheer unity of purpose.

The understanding between the rider and his mount exhibited the kind of teamwork that kept this chain unbroken — from one relay station to another — until the challenge had been met . . . the final goal accomplished.

Bath sales representatives are an important link in the chain between the customer and the Bath plant. Trained to interpret tap problems, they quickly pass on the necessary details to Bath engineers — another link in this important chain.

Bath ground thread taps — regular and custom built — are made with but one purpose in mind . . . to do the best threading job for your requirements. Let the Bath representative tell you how Bath teamwork spells *tap economy* for you!

Bath engineers check every detail, to see that all Bath Taps are conditioned to do the best threading job for your requirements.

Insist on BATH TAPS for BETTER THREADS

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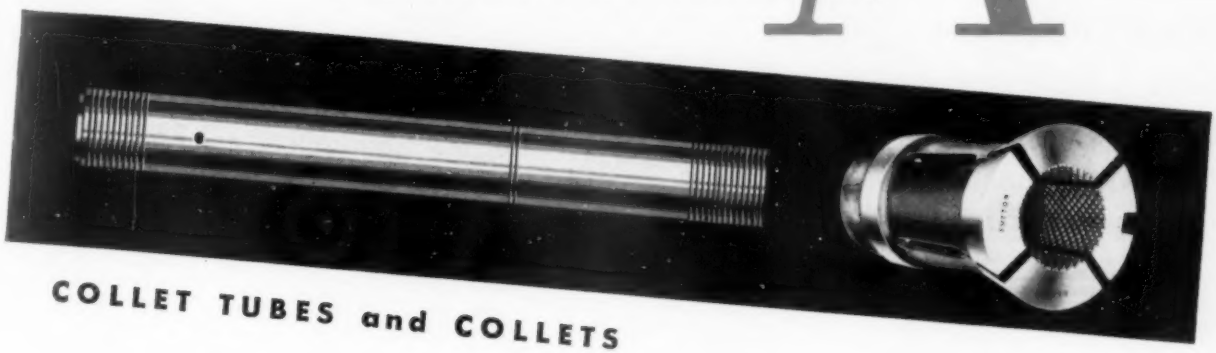
PLUG CYLINDRICAL AND THREAD GAGES • RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

See SUTTON for your AA's

(Accessories for Automatics)



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Sutton's Collet and Feeder Tubes are made to factory specifications from high grade chrome molybdenum seamless steel tubing to insure longer life. Feeder spool and guide bushings are made from high grade alloy steel and are factory duplicates. Sutton furnishes these standard items for many of the more popular machines, to most of the general users.

SPOOL BUSHINGS, FEEDER TUBES and FEEDERS

SUTTON PRODUCTS Include: standard collets, master collets and pads, "full float" master collets and jaws for hot rolled stock, and all types of special collets. Standard feeders, "squirrel cage" super feeders, extra heavy-duty super feeders, master feeders and pads, combination feeders and feeder tubes for oversize stock, chuck jaws and collets for all types of chucking machines, special boring bars, dovetail circular and flat formed tools and cut-off blades.

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Now in its 6th year

NOPAK Shelf-Stock Service...

based on these 2 Standard Mounting, Class 1, Cushioned Cylinders

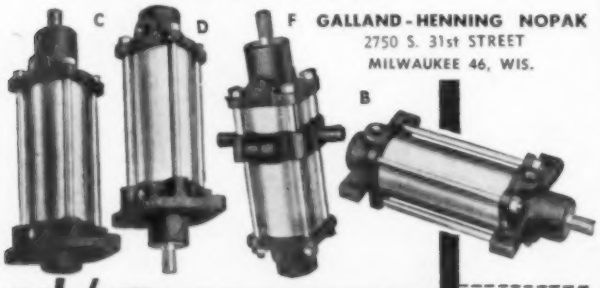
LIST PRICES F.O.B. Milwaukee, Wisconsin — Subject to Revision.

Cyl. Dia. Bore	STOCK STROKE LENGTHS — All Double Acting								
	1"	2"	3"	4"	6"	8"	10"	12"	15"
1½"	24.16	25.72	26.08	26.44	27.16	27.88	28.60	29.32	30.40
2"	26.24	27.88	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	32.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
8"	.....	126.80	129.20	131.60	136.40	141.20	146.00	150.80	158.00

By specifying NOPAK Shelf-stock, you buy *quality cylinders* at lowest prevailing prices, you *eliminate waiting* for "specials", reduce engineering costs. Compare the prices and scope of NOPAK Shelf-stock (1½ x 1" to 8 x 15") with competitive offerings — and you *will specify* NOPAK.

● Basic mountings "A" or "E" convertible to "B", "C", "D" or "F", (see below) by changing cylinder heads. Add 10% to above prices (no extra charge 8" bore). ● Piston Rods NF male thread. ● Cushioning can be eliminated on rod, blank or both ends by removing spring and ball-check.

NOPAK 4-Way Valves, hand, foot, solenoid, or pilot operated, to actuate all cylinders, *also in Shelf-stock.*



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2750 S. 31st STREET
MILWAUKEE 46, WIS.

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

TEAR OUT THIS AD for Reference, — or write for extra copies.

A 8003-½-R

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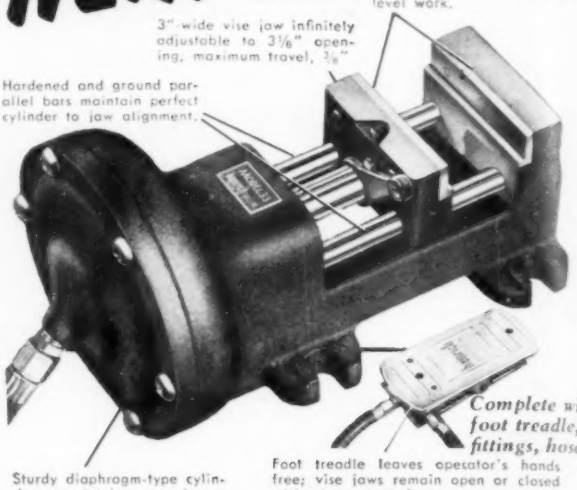
NEW! heinrich Model "33" AIR VISE FOR HIGH-SPEED PRODUCTION

Built-in recessed parallels level work.

3" wide vise jaw infinitely adjustable to 3⅛" opening, maximum travel, ⅜"

Hardened and ground parallel bars maintain perfect cylinder to jaw alignment.



Complete with foot treadle, fittings, hoses

Sturdy diaphragm-type cylinder completely encased.

Foot treadle leaves operator's hands free; vise jaws remain open or closed without constant foot pressure.

Precision-made Heinrich Model "33" Air Vise is easier to set with simple, ratchet-operated, triple-lead thread adjusting screw. Grips with 15 times air line or compressor pressure! All operating parts protected from oil, dirt, chips, etc. Saves tooling costs; use it as base structure.

heinrich
TOOLS, INC.
FORMERLY NATIONAL MACHINE TOOL CO.

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DEPT. 184-K • RACINE, WIS.

Drill Press Vises • Fixture Locks • Nibblers
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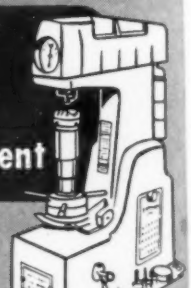
ACCO products

Wilson "Rockwell"* Hardness Testers

A FULL LINE to meet every hardness testing requirement



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- Semi-Automatic
- Special
- Superficial
- Tukon Micro & Macro
- Regular

Hardness testing standards of the metal industry have been set and maintained by WILSON "ROCKWELL" Hardness Testers since 1921. In steel mills, non-ferrous mills and metal fabricating plants everywhere, WILSON "ROCKWELL" standards have been the mark of perfection for a generation.

What is your testing problem? Whether your material is hardened steel, sheet metal, small parts, tools, rounds, tubes, soft metals or plastic materials—all are tested quickly and accurately by one of the many WILSON models.

Let a WILSON expert discuss your hardness testing problem. There is no obligation.

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plus BRALES and Accessories

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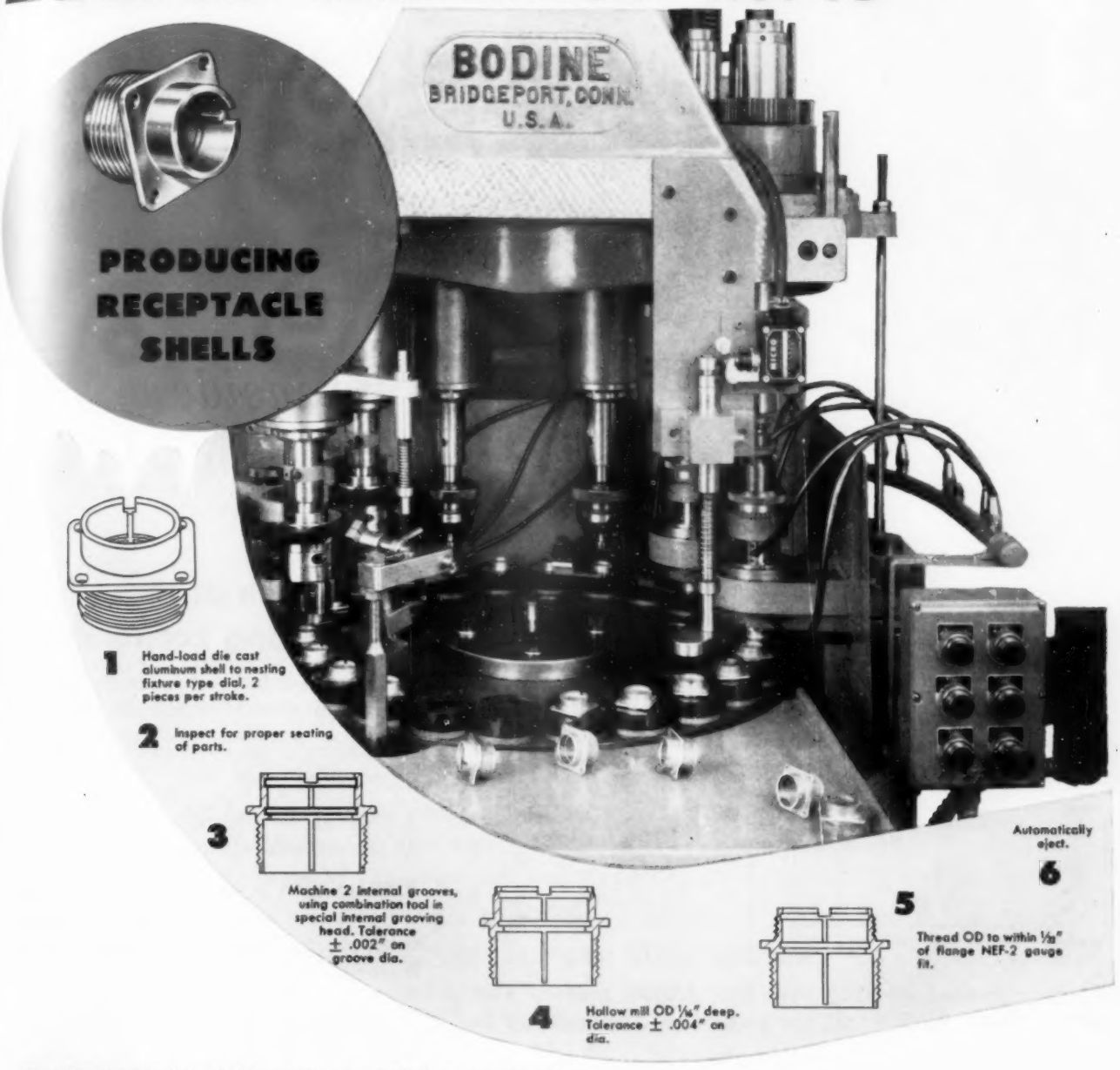
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1 Hand-load die cast aluminum shell to nesting fixture type dial, 2 pieces per stroke.
2 Inspect for proper seating of parts.
3 Machine 2 internal grooves, using combination tool in special internal grooving head. Tolerance ± .002" on groove dia.
4 Hollow mill OD ¼" deep. Tolerance ± .004" on dia.
5 Thread OD to within ½" of flange NEF-2 gauge fit.
6 Automatically eject.

This Bodine Model 48-30 machine is tooled to handle 13 receptacle shells ranging from 7/16-27 to 1⅝-18 NEF 2 threads. Shells are used for multiple terminals in TV, Radar, etc.

PRODUCTION: From 1,600 to 2,200 pieces per 50-minute hour, depending on size of shell.

Potentiometers next to push button station regulate two electronically controlled variable speed motors. Positive, accurate control over spindle rpm and over rate of feed gives lead-screw accuracy to the threads with a non-reversing spindle.

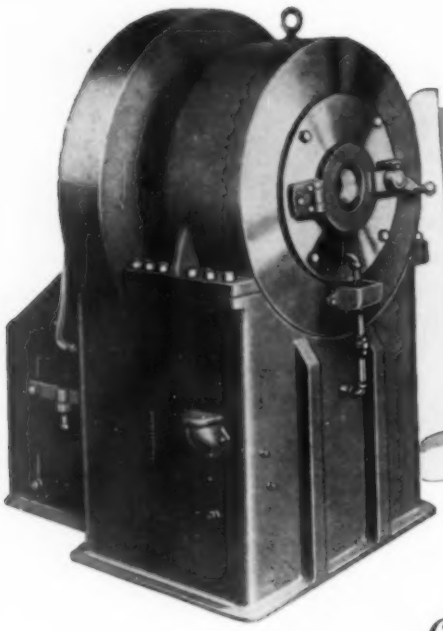
Bodine machines (of four types) may be tooled for an extremely wide variety of high speed repetitive production jobs . . . including drilling, tapping, threading, screw inserting, light milling, and assembly. For a true picture of cost cutting, write Dept. TE-10 for our brochure "Bodine Presents 12 Typical Case Histories."

"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools."

THE **Bodine** CORPORATION
BRIDGEPORT CONNECTICUT

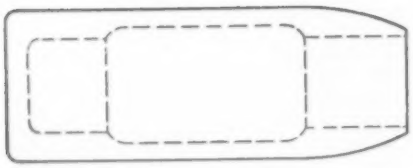
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

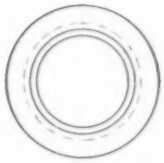
68D54



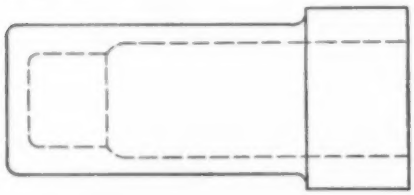
Swaging Success Stories

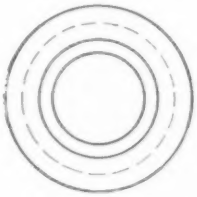
Shaping inside chamber...simplifies machining



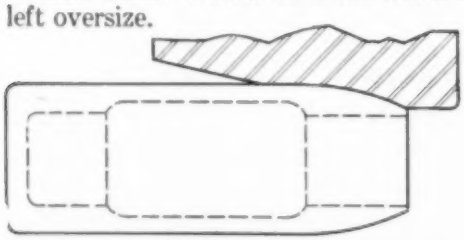


This finished piece with its specially shaped inside diameter presented a problem until Torrington's swaging experts were called in.





They suggested starting with this drilled, reamed and formed blank. Notice that the material at the open end is left oversize.



One swaging operation in dies designed for the job shaped the inside chamber as well as the outside to the desired contour.

Look at these Swaging Economies

1. Swaging is fast—it is ideally suited to mass production of special shapes.

2. Swaging is easy—it can be performed by unskilled labor.

3. Swaging is efficient—it utilizes nearly all the material without waste.

4. Swaging is inexpensive—it eliminates many costly screw machine operations, while giving metal better finish and resiliency.

For more information on swaging as a method for shaping or reducing metals, write for our informative booklet. It describes in detail the Torrington Rotary Swagers that may be able to help you write a "swaging success story" in your own plant.

THE TORRINGTON COMPANY
Swager Department
444 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

TORRINGTON ROTARY SWAGING MACHINES

Which is the CleCap?

. . . the one you can get pronto!

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We can't resist a rave about the product—CleCap's double extruded Socket Screws . . . Real *sockets* you'll admire—they're true hex, sharp cornered to give the key good "purchase", and *clean,* clear to the bottom.

"Sockets" are just one of the fastener styles CleCap makes. On any of the items cataloged below, let CleCap show you how they can make your idea of delivery a reality. If you haven't tasted CleCap service you've missed a thrill.

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Hex Head Cap Screws: ¼" to 2½" dia.
Socket Head Cap and Set Screws—Plain and Knurled: ¼" to 1½" dia. Also Flat and Button Head Styles.
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Fillister Head: ¼" to 1¼" dia.
Set Screws—Square Head: ¼" to 1½" dia.
Milled Studs: ¼" to 1¼" dia.
Place Bolts: ¼" to 1⅛" dia.
Structural Bolts to ASTM Specification A325
Tractor Bolts
Special Hot and Cold Headed Parts

Facilities to make larger diameters than listed.

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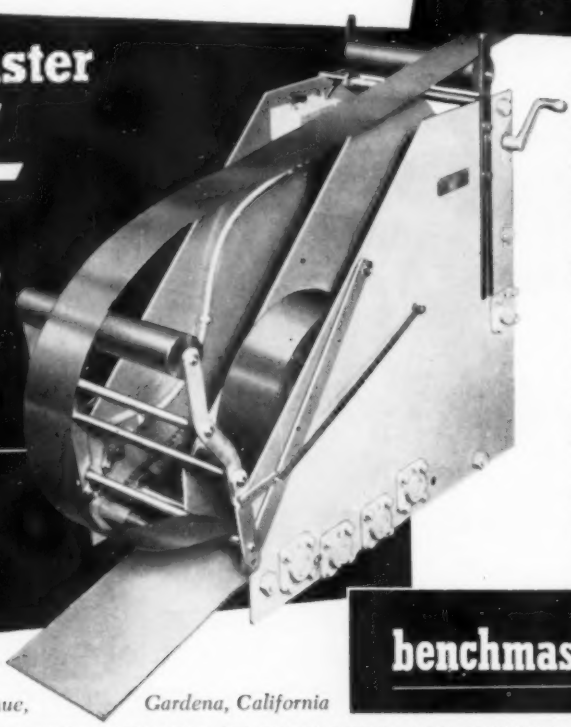
with VARI-LOOP Control



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Capacities from ½ ton to 8 tons, coil dias. 36" to 60" stock widths 10" to 48".

KOIL-KRADLE makes available a *controlled length of slack loop* from which any machine can draw ...shuts off automatically when loop exceeds machine requirements.

KOIL-KRADLE CUTS COSTS! Uses much larger coils; lowers stock costs; eliminates frequent reloading. This means more press time, more production, more profit.

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SAVES VALUABLE FLOOR SPACE—No need for 8 to 10 feet of wasted space... KOIL-KRADLE butts against any machine it supplies. Compact, occupies only a few feet of floor space itself!

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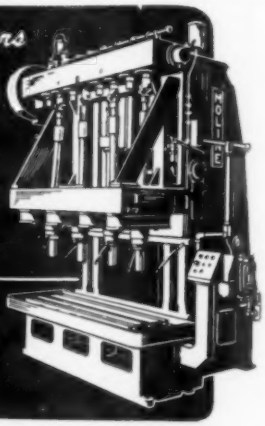
For Over 50 Years
"HOLE-HOG"
Specially Designed
MACHINE TOOLS
Have Cut Production Costs for American Industry



MOLINE TOOL CO. "HOLE-HOG" MOLINE, ILLINOIS

No. HU68—Hydraulic rail feed universal joint type multiple spindle drilling machine.

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MILLED STUDS SET SCREWS
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Ottemiller products are sold through Mill Supply Houses and Industrial Distributors.

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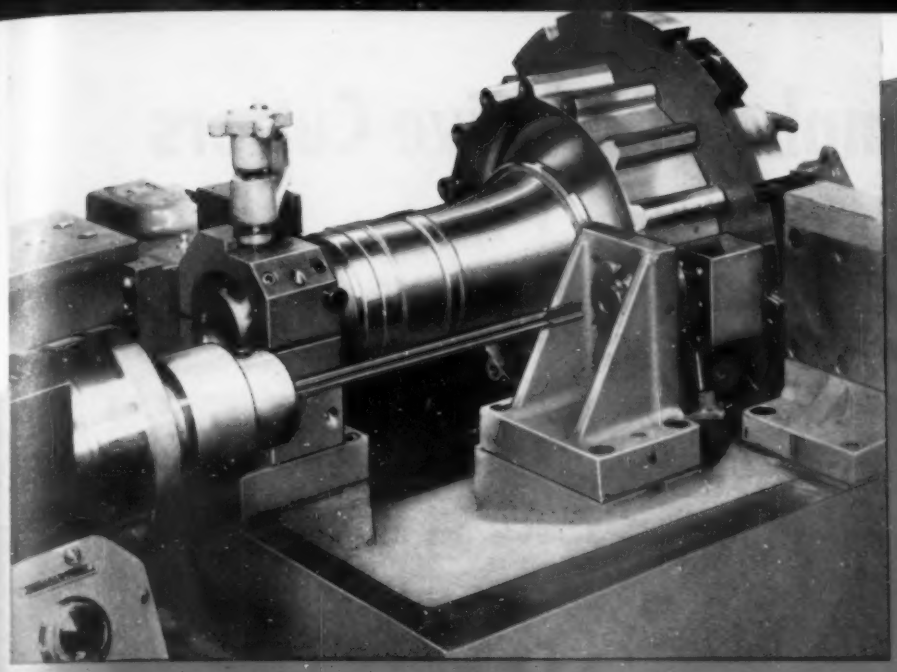
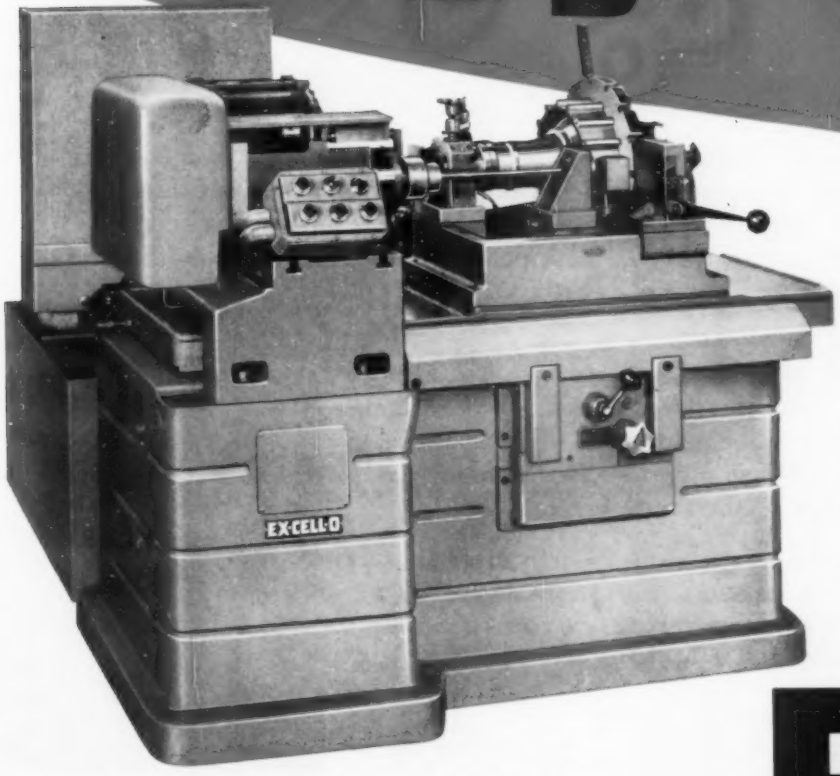


S.A.E. 4340 aircraft part before and after 15 Bor-Dril holes. Hole size and location are held within plus or minus .001".

The workpiece is clamped in an arbor having an index plate. Note the gun drill about to enter the guide bushing. Holes are ½" diameter, 3⅜" long.

EX-CELL-O ANNOUNCES BOR-DRIL



THE MODERN APPROACH WITH GUN-TYPE DRILLS

Ex-Cell-O Precision Machines are ideal for Bor-Dril machining of close-limit holes from the solid because of their smooth, easily-adjusted feeds and vibration-free construction.

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

54-48

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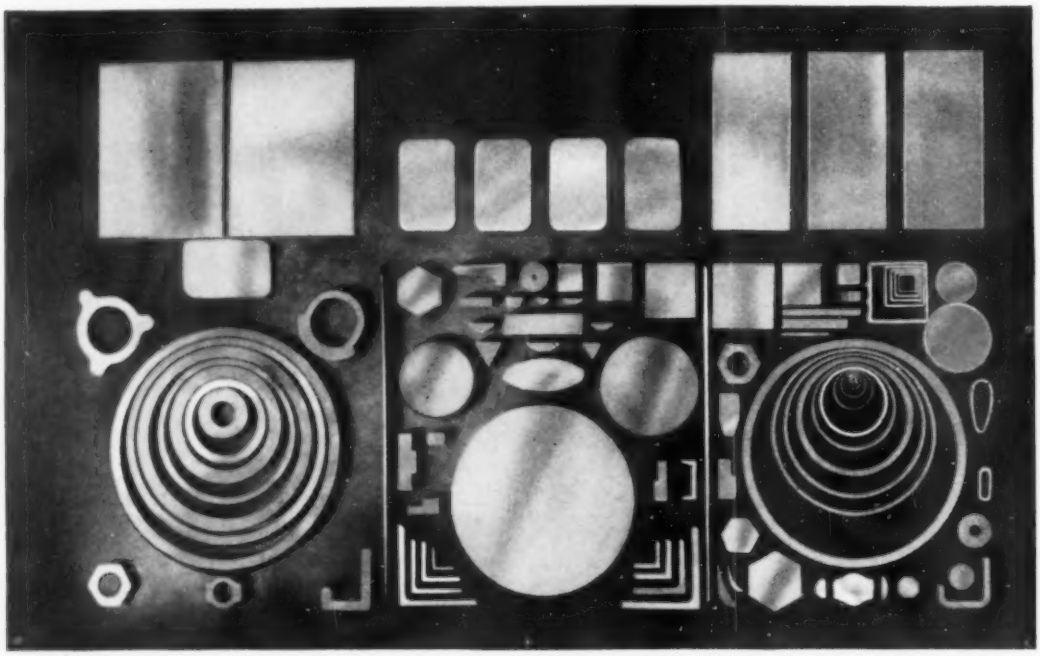
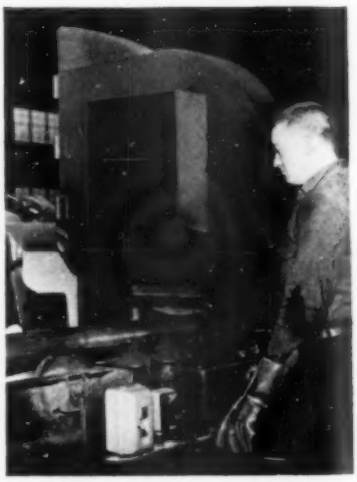
Campbell Abrasive Cutters

International Nickel Uses CAMPBELL ABRASIVE CUTTERS for wide variety of fine cutting operations



With the exception of the strip plates and sheet stock, the pieces of Monel* shown here have been cut by International Nickel on CAMPBELL Abrasive Cut Off Machines. The largest section is approximately 10″ in diameter. These same CAMPBELL Abrasive Cutters also are valuable for fine cutting operations on stainless steel, alloy and other steels difficult to cut.

This is a **Model 480** CAMPBELL Abrasive Cutter at work in a warehouse of International Nickel. At the time this picture was taken it was cutting "K" Monel*, 4¾″ in diameter. Time of cut was two minutes. This machine has the capacity to handle material up to 8″ square (8″ x 8″).



CAMPBELL Abrasive Cutters are available in the widest variety of styles and models—fully automatic and semi-automatic. Write for CAMPBELL *Bulletin* **DH-301** *on the* CAMPBELL *Abrasive Cutting Method.*

*Registered Trade Mark
International Nickel Co., Inc.

ACCO

Campbell Machine Division
AMERICAN CHAIN & CABLE

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Wet and Dry Cutters and Nibblers

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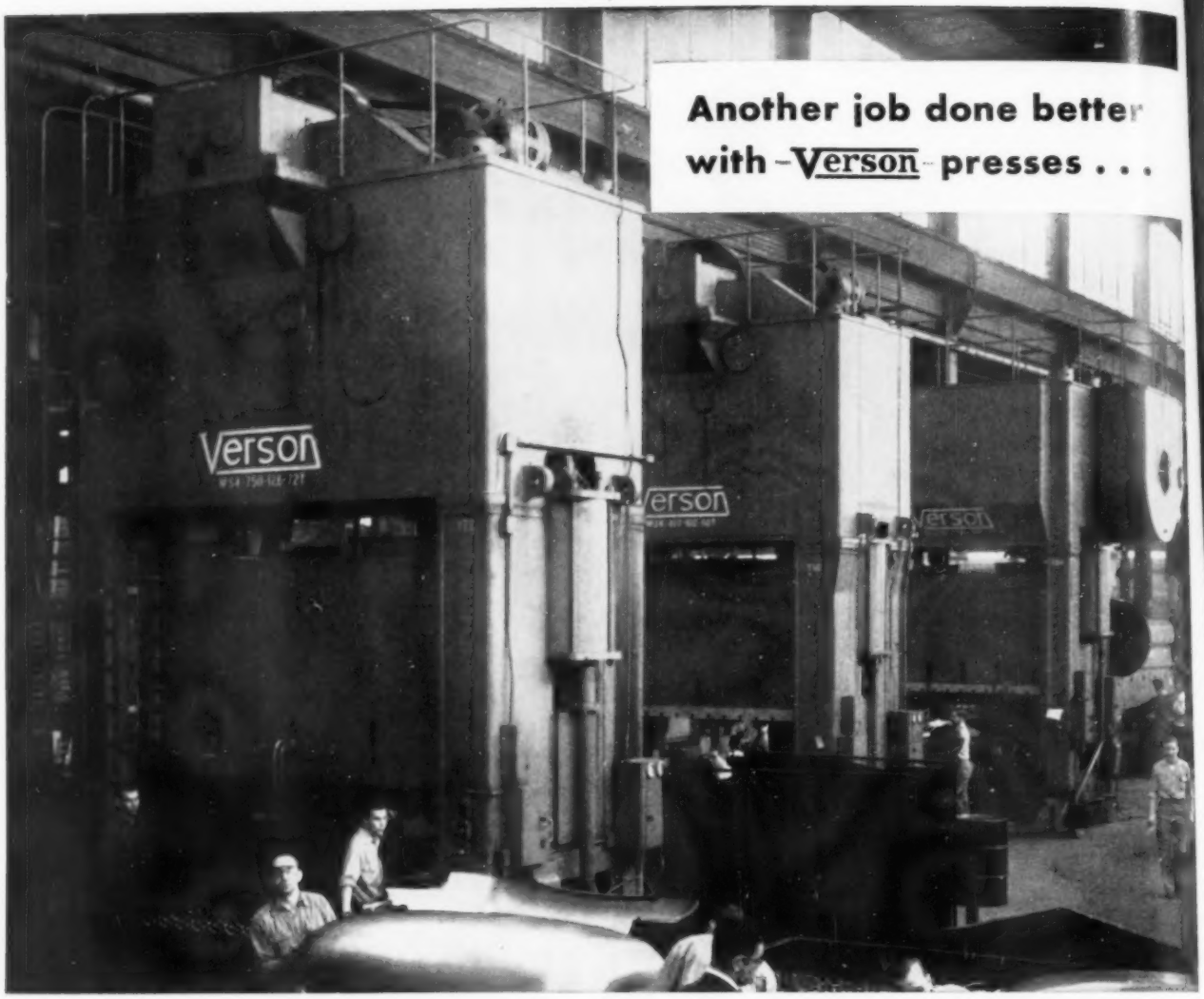

This -Verson- line-up turns out truck cab tops for Morrison Steel Products, Inc.

Typical of the countless routine jobs that are being done better every day with Verson Presses are the truck cab tops manufactured by Morrison Steel Products, Inc. Buffalo, New York. In the line-up shown above are two Verson four point full eccentrics rated at 750 tons and 400 tons and a Verson two point full eccentric of 750 tons capacity.

Nothing outstanding about this installation?

No, except that like so many manufacturers doing routine jobs, Morrison Steel Products has taken advantage of Verson's high standards of performance and economy. For the manufacturer this means better stampings at lower overall cost. This is proved by experience on all kinds of jobs over a period of a third of a century.

Whatever your press needs, whether the job is routine or one-of-a-kind, it will pay you to put Verson's experience and know-how to work for you. Catalog G-52 summarizes the complete Verson line and gives typical specifications. Write for your copy, today. There is no obligation on your part.

A Verson Press for every job from 60 tons up.

Verson

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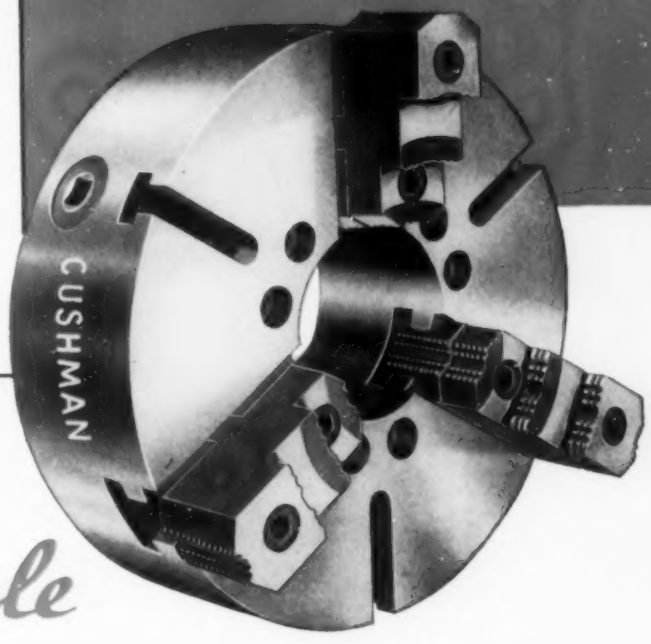
gives you CHUCK-ABILITY

CHUCK-ABILITY:

The ability to SPEED your work... ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices.

Remember:

You can't machine it right unless you hold it right



an example

. . . of this is Cushman's 3-Jaw Heavy Duty Self-Centering Chuck for use on turret and automatic lathes. This chuck is but one of many types of manually operated chucks designed and built by Cushman to serve the metal-working industry with long life and continued accuracy. True heavy-duty construction with ample sections, correct weight distribution and precision balance makes these chucks a first choice with heavy-duty machine tool builders. These chucks are given a thorough inspection to meet present-day high standards of precision.

Find out what Chuck-Ability can do for you . . . write Cushman for Catalog No. 65-1953 fully describing and illustrating our Manually Operated Chucks . . . or, should you have a special work-holding problem, consult the Cushman Engineering Department.

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Only ONE can be called the Finest:

. . . here's another good reason why:

CARLTON'S LOW HUNG DRIVE

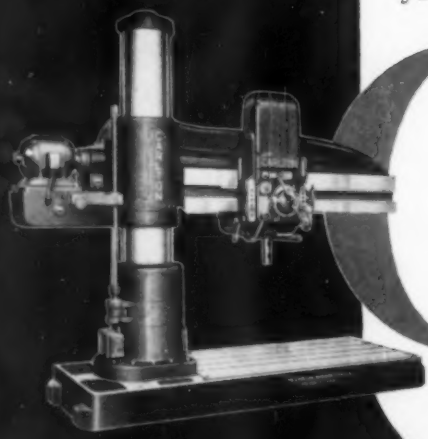
BRINGS THE HEAD *and* SPINDLE down to the work . . . not just the spindle.

Spindle accuracy and rigidity are assured *because the spindle is always close to the radial arm support.* This design eliminates spindle twist, which is one cause of vibration, thus reducing manufacturing costs by increasing tool life.

The main drive gear is placed in the *lowest part of the head.* It drives on the *largest diameter* of the spindle, *closest to the cutting tool* . . . a principle well established by its wide use in planers, lathes and milling machines. This permits the greatest amount of torque transmission.

Carlton's low hung drive . . . plus *all-ball-bearing construction, centralized pushbutton control, modern lubrication, 3-unit power clamping of arm, head and column,* and Carlton's many other advantages . . . means increased 'hole' production for you.

Write today for bulletins describing the Carlton Radial Drills you need. The Carlton Machine Tool Co., Cincinnati 25, Ohio.



Carlton radial drills

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For Smooth Finish and Economy

A *complete* line of Reamers, offering a wide range of types and sizes for every requirement. All are correctly engineered to give you accuracy, efficiency, long life and *more holes per grind.*

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why WALES HOLE PUNCHING & NOTCHING EQUIPMENT *Can't be beat!*

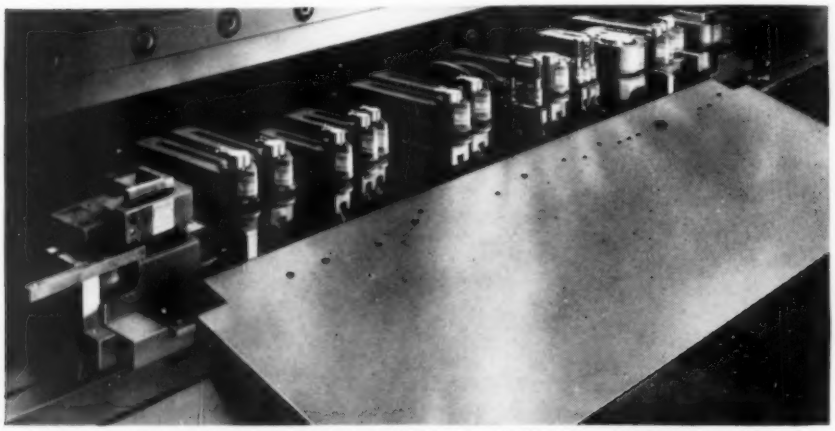
Independent, self-contained Wales Hole Punching and Notching Units *reduce setup time from hours to minutes.*

Check these Wales time saving, money saving advantages:

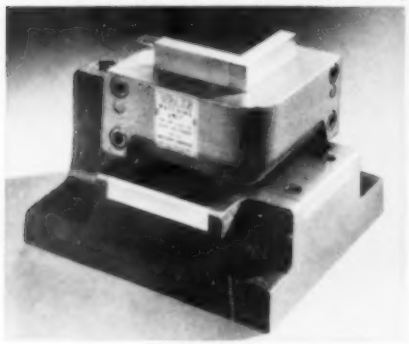
- ▶ Nothing attached to press ram
- ▶ Interchangeable punches and dies
- ▶ Punches and dies always in perfect alignment
- ▶ No die set required
- ▶ Press "down time" practically eliminated
- ▶ Used and reused in unlimited setups
- ▶ Makes setup a simple, quick assembly operation

Wales Hole Punching and Notching Units "can't be beat."

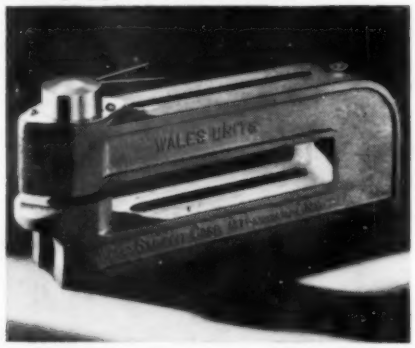
IT'S TOO BIG A STORY TO TELL ON THIS PAGE SO . . .



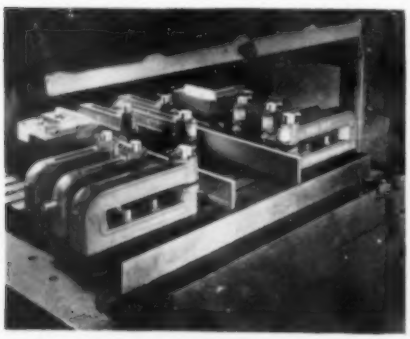
Showing a staggered hole punching setup of Wales Type "BL" Units with Wales Type "NA" Notching Units at each end for hole punching and notching in the same operation on a press brake. These same Wales Units may be set up in a stamping press as shown at bottom.



Wales Type "NA" Notching Unit for notching 90° corners.



Wales Type "BL" Hole Punching Units for punching round and shaped holes up to 2" in diameter.



Wales Hole Punching and Notching Units set up on "T" Slotted Plate in a stamping press.

Showing Wales Hole Punching and Notching Units set up on a template in a stamping press.

Write for COMPLETE, FULLY-ILLUSTRATED, FUNCTIONALLY COLORED CATALOGS BL and N **NOW**

WALES-STRIPPIT CORPORATION

George F. Wales, Chairman

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(Between Buffalo and Niagara Falls)

Wales-Strippit of Canada Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment

Fig. 1

producing this pulley assembly shows off the versatility of Hydroforming

Fig. 2

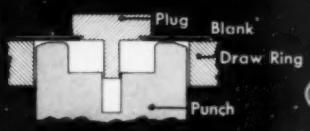


Fig. 3

Fig. 4

Fig. 5

In addition to drawing simple or intricate shapes, the Cincinnati Hydroform accomplishes simultaneously what are considered conventional *die set* operations. This is illustrated by the ingenious method used to produce the forming operations for the experimental short run pulley assembly shown in Fig. 1.

The pulley flange section (Fig. 2) was Hydroformed complete in *one* operation from a flat, 8″ dia. blank of 0.062″ cold rolled steel having a 2½″ dia. center hole. The walled hole was produced at the same time as the balance of the part by use of a piloted plug which formed the material into a recess in the punch. (See Fig. 3.)

The hub flange section (Fig. 4) was produced in *two* operations. The hub was first drawn using conventional Hydroform tools—a punch and draw ring. In the second operation, a ring was used to form the balance of the part. (See Fig. 5.) This combined a forming and a restriking operation which produced the required dimensional accuracy, including the sharp 0.060″ compound radii on the flange.

Thus the Hydroform can often be tooled inexpensively to do *more* than deep drawing and forming, saving operations which *further reduce* the cost of your development work . . . or your short run parts production. Let a Cincinnati Milling field engineer give you complete details. General Hydroform data and specifications of the 8″, 12″, 19″, 23″, 26″ and 32″ machine sizes are given in Bulletin M-1759-2. Write for your copy.

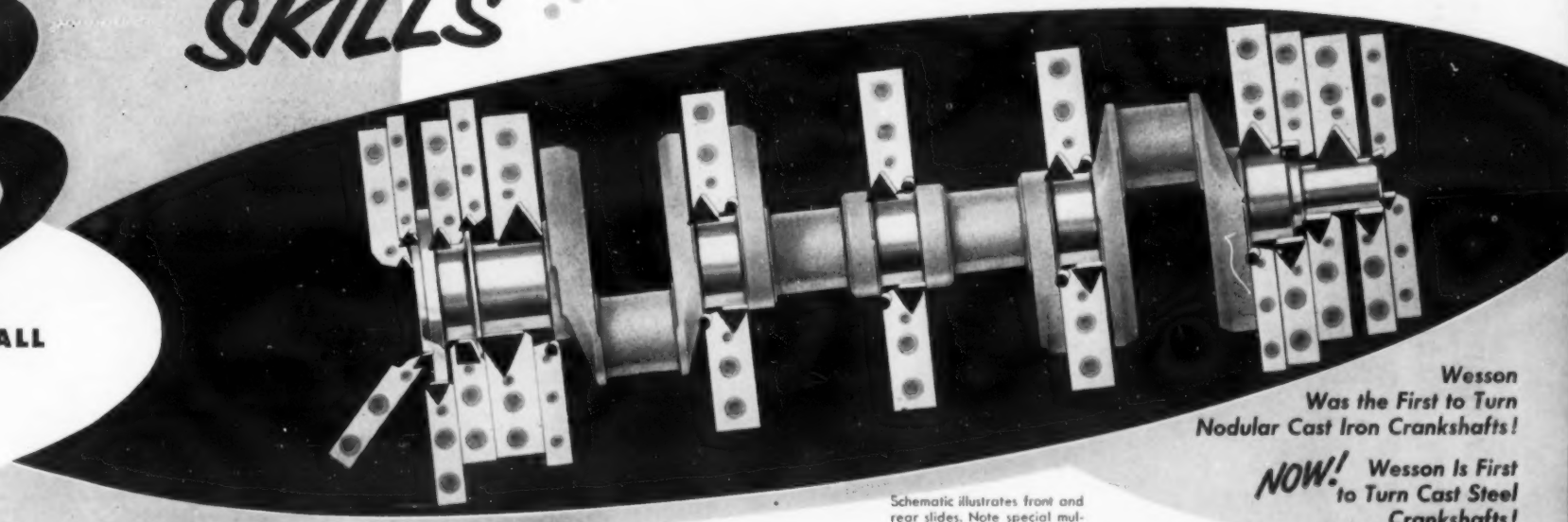
CINCINNATI **Hydroform** **THE CINCINNATI MILLING MACHINE CO.**
CINCINNATI 9, OHIO, U.S.A.

WESSONMETAL
Carbide Blanks

WESSON
Carbide Cutting Tools

WICKES

COMBINED SKILLS ..... FIRST TO TURN CAST STEEL CRANKSHAFTS!



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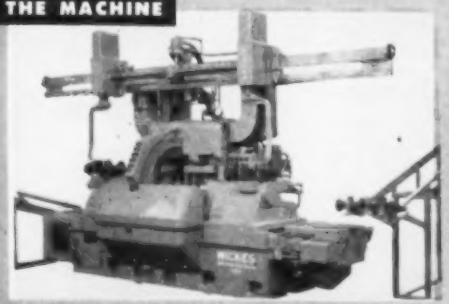
- More Productive Tools
- More Productive Machine Tools
- More Uniform Quality Carbide
- Lower Costs

Wesson Was the First to Turn Nodular Cast Iron Crankshafts!

NOW! Wesson Is First to Turn Cast Steel Crankshafts!

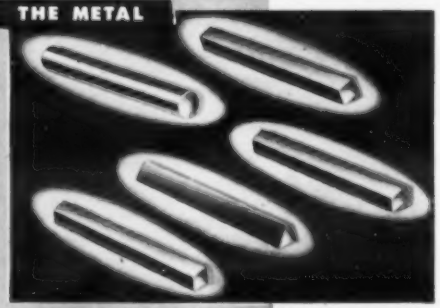
Schematic illustrates front and rear slides. Note special multiple tool adaptations possible only with Band-Type Multicuts!

THE MACHINE



Wickes lathes used on this tough operation are the result of engineering-design experience gained from many years of solving hundreds of specific machine tool problems.

THE METAL



Wessonmetal uniformity of grade is the key to outstanding performance in single and multiple insert set-ups on all types of material. Every Wessonmetal insert or batch of inserts is engineered to cut produce on every type of operation. Wessonmetal uniformity is the result of unique and exacting quality control.

THE TOOLS

Wesson Multicut Band-Type Tool Holders are tailor-made for single and multiple tool set-ups. Exclusive features include "built-in flush gage" for quick, accurate insert set-up" in the machine; low cost steel band is replaceable, insert removal slot permits fast and easy insert removal. The body is practically indestructible! Available in over 100 standard sizes—11 styles!

THE MEN

Credit lines above are typical of Wesson's thorough approach to "tough" tooling problems." Working together with the metallurgist, the Tool Engineer, Machine Tool Builder, and the customer, Wesson Field Engineers combine skill and experience in the solution of big jobs like the steel crank and single point tool applications in small production runs!

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY

WESSON COMPANY
1220 WOODWARD HEIGHTS BLVD., FERNDALE 20, MICHIGAN

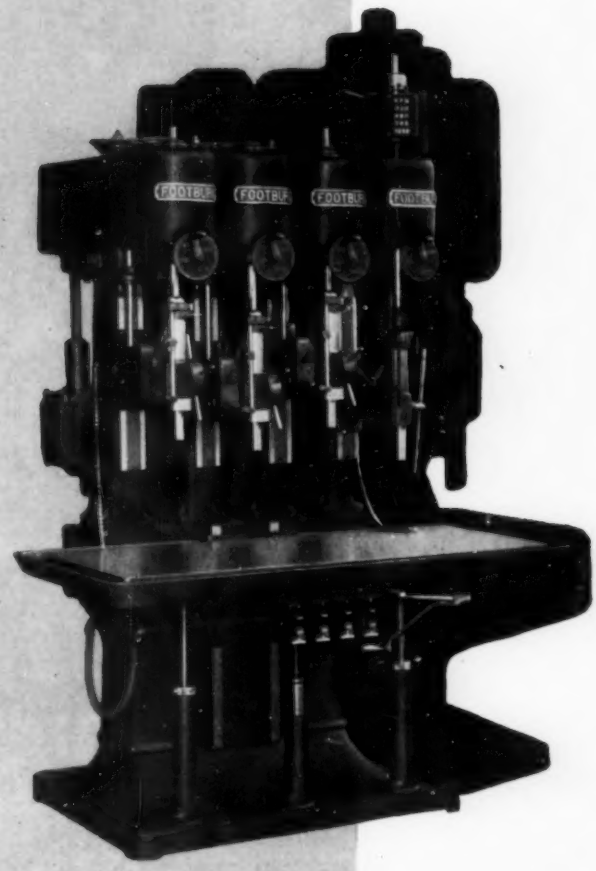
FOOTBURT

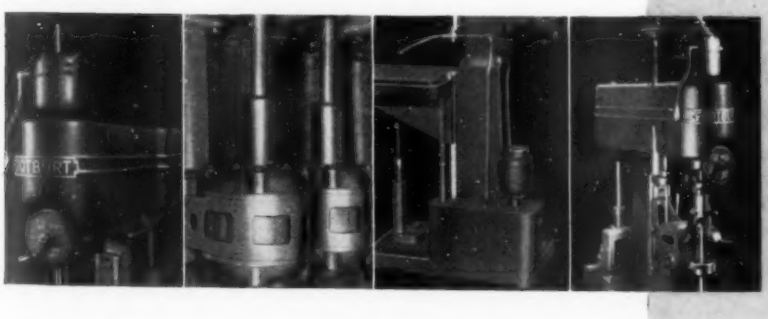
sensitive drilling machines

A FULL RANGE
DRILLING MACHINE
ENGINEERED FOR PRODUCTION

Built carefully to provide the required accuracy for fine tool room work, Footburt Sensitives are designed with the weight and stability to maintain close tolerances on day after day production work. The correct speed for a wide range of drilling, reaming, and counterboring operations is instantly available. Write for full information on this great line of Sensitive Drilling Machines. Built in 1, 2, 3, 4, 6 Spindle Models.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building





No. 2 Machine with Back Gear • 12" Overhang • 5/8" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.

☆ *engineered for production*

FOOTBURT

MACHINE TOOLS

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-10-261

OSBORN

From 50 minutes to 6. Burr removal and finishing of rack gears was formerly a 50-minute job by hand. Now, with the machine shown and Osborn Fascut® Brushes, the job takes only 6 minutes. Smoothness and uniformity are far superior.

8 times as fast!

What could this study do for you?

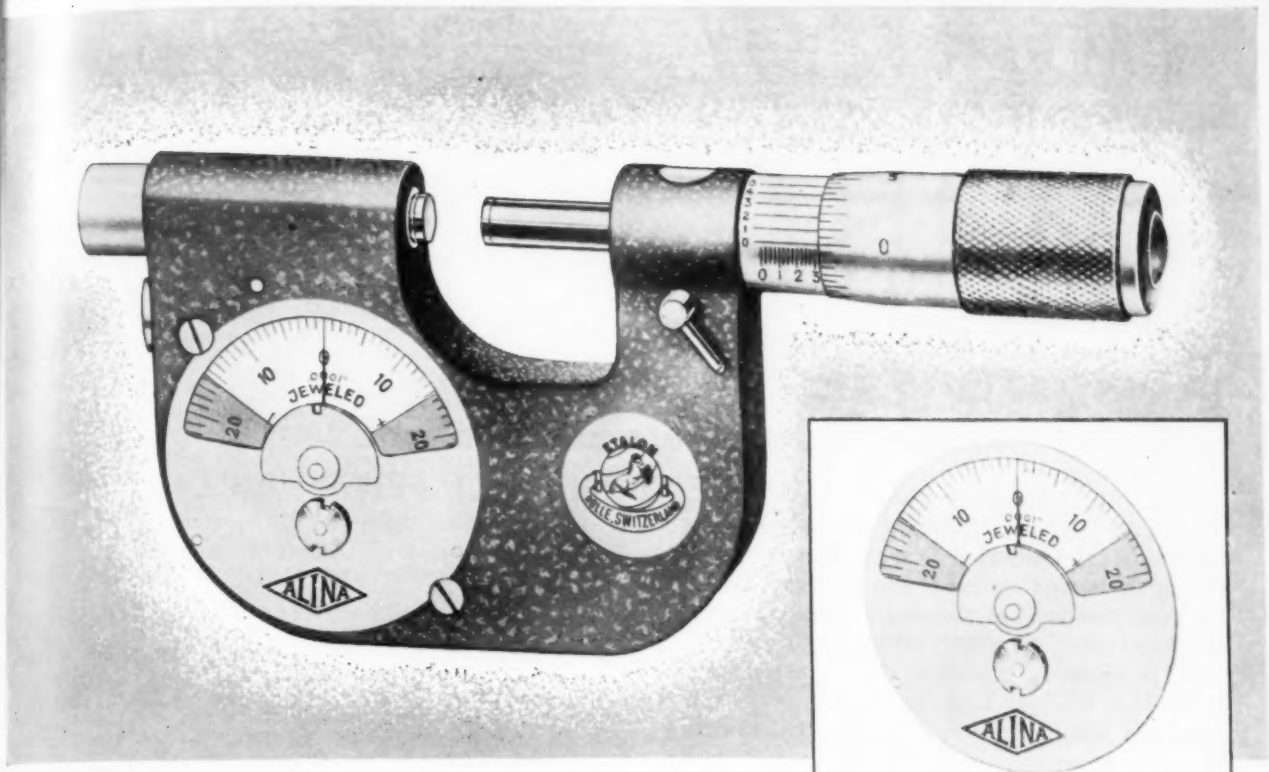
THE burr-removal and finishing job shown above formerly took 50 minutes. Now, with Osborn Power Brushing, it takes only 6 minutes and the product is far superior. Helping to get results like this is the big objective of Osborn Brushing Specialists when they make an **O**sborn **B**rushing **A**nalysis.

It will pay *you* to have an **OBA** made of your production cleaning and finishing operations to find out definitely where the latest power brushing techniques can improve quality and cut your costs. Call or write *The Osborn Manufacturing Company, Dept. K-11, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

How he works. In making an **OBA**, your nearby Osborn Brushing Specialist studies your production with an eye to improving cleaning and finishing operations with power brushing. He gives you a written report with recommendations. His extensive experience is backed up by the facilities of the Osborn Technical Department.

Osborn Brushing Analysis

TO HELP YOU DISCOVER HIGHER QUALITY AND LOWER COSTS WITH POWER BRUSHING



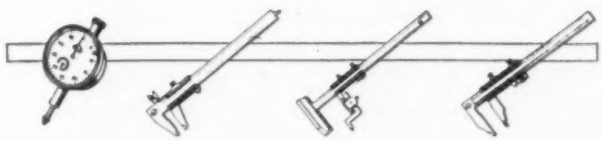
To simplify fine adjustment, the dial may be rotated as much as three graduations, on either side of zero. Built-in tolerance hands, individually adjustable: *blue* for undersize, *red* for oversize.

NEW! Etalon No. 25N Indicating Micrometer

ALWAYS REPEATS!

The Etalon No. 25N combines the precision of the dial indicator with the accuracy of the micrometer screw. It eliminates the chance of human error—"feel"—common to setting an ordinary micrometer . . . eliminates the need for "go and no-go" gauges, since you can set it to the required size, lock it and then gauge your parts. Retractable anvil permits quick and easy introduction of the part to be checked without danger of scratching. Load on the anvil retracting mechanism is adjustable; the mechanism can in no way influence reading. Etalon No. 25N may be used in the hand or mounted in a micrometer stand.

- *jewelled*
- *shock-proof*
- *variable anvil pressure*
- *carbide measuring faces*
- *dial and micrometer barrel graduated in .0001"*
- *one piece hardened stainless steel screw*



ETALON
ACCURACY

Ask your dealer to show you the complete selection of ETALON instruments or write

ALINA CORPORATION
401 Broadway, New York 13, N. Y.
In Canada: Swiss Instruments Co. Reg'd., Granby, Quebec

AT LAST!

TROUBLE FREE

D-E-E-P HOLE DRILLING WITH BOYAR-SCHULTZ

MODEL RDA **REVOLVING DEEP HOLE DRILLING TOOL** *AND*

MODEL VD **DEEP HOLE DRILL DRIVING UNIT**

A NEW TOOL incorporating all the features of our Model DA Deep Hole Drilling Tool, including the oscillating action, but it also revolves, providing additional R. P. M. for smaller diameter drills. In actual practice a .050 drill will go into the work 16 times its diameter without a pull-out. Heretofore, inadequate surface feet for small diameter drills made this time and cost saving operation impossible.

CHECK THESE ADVANTAGES

1. Oscillating chip breaker eliminates chip problems.
2. Revolving drill allows wider range of surface feet on all types of materials.
3. Depths of 16 times drill diameter in *steel* without pull-outs.
4. Spring motor mounting design maintains constant belt tension, allowing free movement of turret slide.
5. Variable speed pulleys.
6. Unit operates either right or left hand.
7. Readily adaptable to No. 00, No. 0 and No. 2 Machines.
8. Mounts on machine without drilling or machining.

3168

BOYAR-SCHULTZ CORPORATION

2004 South 25th Avenue, Dept. E-S, Broadview (Chicago), Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-264-1

Twin Time and Money Savers!

WAHLSTROM Instant-change CHUCK saves up to 95% of tool-change time! Spindle never stops. Requires no keys, collets or wrenches. Self-centering jaws automatically grip without slip, do not chew up drill shanks. No other chuck like it!

FLOAT-LOCK SAFETY VISE instantly grips or releases work of almost any shape for SAFE drilling in any position. Prevents accidents and minimizes drill breakage. Also serves as base for low-cost jig. Comes with 9" or 12" jaw openings. Also model for band saws.

Ask your distributor for a demonstration or write us for folder W-50.

WAHLSTROM
FLOAT-LOCK SALES DEPT.
American Machine & Foundry Company
Room 26, 261 Madison Ave.,
New York 16, N. Y.

Another AMF Product

WAHLSTROM Chucks
Float-LOCK Vises

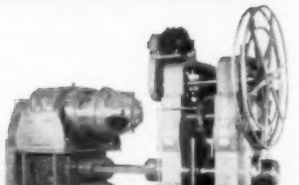
USE READER SERVICE CARD: INDICATE A-10-264-2

THERE'S NO SUBSTITUTE FOR KNOW HOW

Your

RUTHMAN GUSHER COOLANT PUMPS

give you



Illustrated is a Fenn No. 121 Two High Roller Bearing Rolling Mill equipped with a Model 5-P3 Long Gusher Coolant Pump.

1 ***Experience in Design*** . . . Ruthman Gusher Coolant Pumps were first in their field and have maintained their leadership over the years. Ruthman engineers are constantly at work to bring you an even better Gusher Pump.

2 ***Precision Built.*** Only tested materials and the best workmanship go into your Gusher Coolant Pumps. You can be sure of a long trouble-free life.

3 ***Efficient Operation*** is inherent in Gusher Pumps. You get split-second coolant flow and they require no priming or packing.

Always Specify Ruthman Gusher Coolant Pumps.

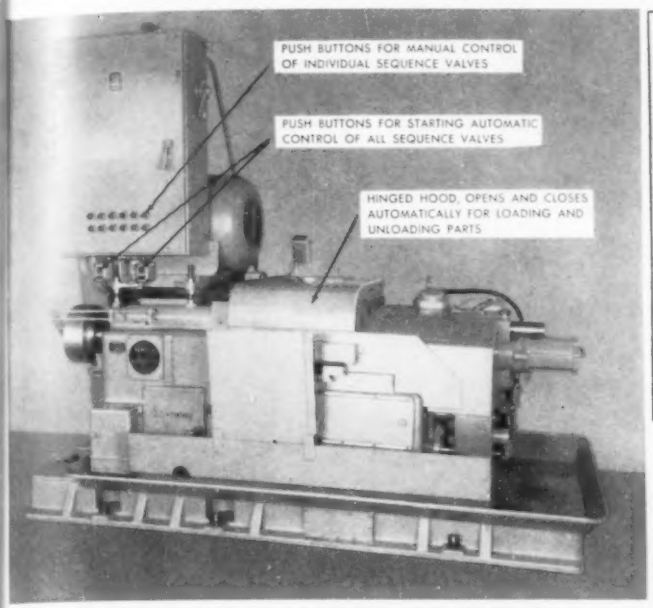
THE RUTHMAN MACHINERY CO.

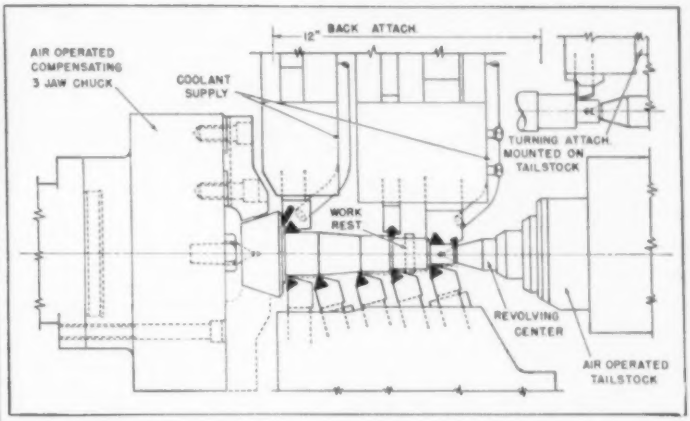
1810 READING ROAD — CINCINNATI, OHIO

USE READER SERVICE CARD; INDICATE A-10-264-3

MACHINE OF THE MONTH

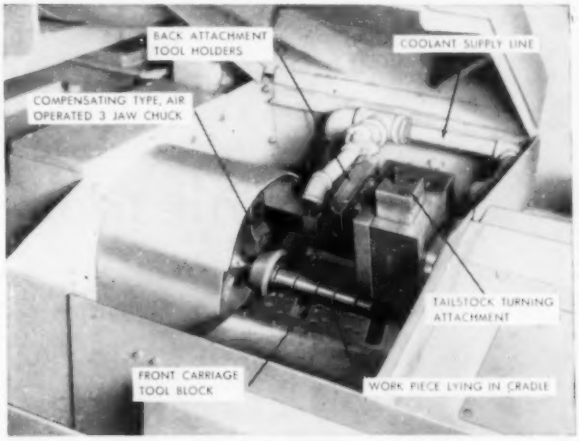
PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK


PUSH BUTTONS FOR MANUAL CONTROL OF INDIVIDUAL SEQUENCE VALVES
PUSH BUTTONS FOR STARTING AUTOMATIC CONTROL OF ALL SEQUENCE VALVES
HINGED HOOD, OPENS AND CLOSES AUTOMATICALLY FOR LOADING AND UNLOADING PARTS



◀ *Tooling area of machine is entirely enclosed, protecting operator from flying chips and coolant.*

▼ *Hinged hood in open position for loading and unloading parts.*


BACK ATTACHMENT TOOL HOLDERS
COOLANT SUPPLY LINE
COMPENSATING TYPE, AIR OPERATED 3 JAW CHUCK
TAILSTOCK TURNING ATTACHMENT
FRONT CARRIAGE TOOL BLOCK
WORK PIECE LYING IN CRADLE

Lo-swing LATHE EQUIPPED WITH AUTOMATIC CONTROLS REDUCES HANDLING TIME...

Problem: To reduce handling time and operator fatigue in machining operations on Axle Pinions.

Solution: A Model AR Automatic Lo-swing Lathe, tooled as illustrated, was selected for this job. Work is held on centers and driven with an air-operated, three-jaw compensating chuck. Five carbide front turning tools, two of which are template operated, reduce the length of cut to 1-7/8", which is the length of the taper portion. An additional tool, mounted in a tailstock turning attachment, partially removes surplus material on the threaded diameter in advance of the front turning tool which finish turns this diameter. Six carbide tools on the rear slide face and chamfer the shoulders.

The machine stops automatically at the end of the cycle with spindle stopped, chuck jaws released, tailstock center retracted, hinged hood open and with the machined part dropped into a cradle. The operator simply replaces the finished part with a rough forging and then pushes the two starting buttons, energizing the loader controls, which consecutively close the hood, places the work between centers, closes the chuck jaws and finally starts the headstock spindle rotation. The automatic cycle from then on is controlled by automatic camming built into the base machine.

The tooling area of the machine is entirely enclosed to protect the operator from flying chips and coolant, while cutting at high spindle speeds. Two starting buttons, wired in series, oblige the operator to use both hands, and are so located that the operator is out of range of the closing hood, thereby preventing accidents.

Control buttons on the door of the starter panel permit normal operation of individual controls and are convenient for setting up and timing loader movements.

Seneca Falls engineering staff is at your disposal to help solve your engineering problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

Which will it be—?

Price
Cost

As you well know, *price* of new equipment is only the beginning. Actual production savings determine real equipment *cost.*

From this realistic *cost* standpoint you can't beat Erickson collet chucks. Here's why:

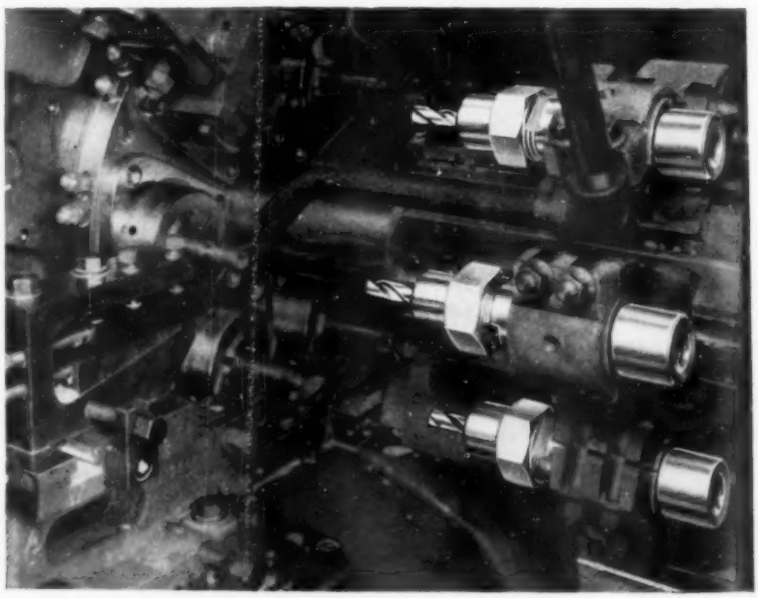
Guaranteed accuracy of .0005" and superior gripping power of Erickson collet chucks assure proper drill alignment. Drills then cut evenly on both cutting lips permitting faster machine feeds and proper speeds . . . give more holes per grind.

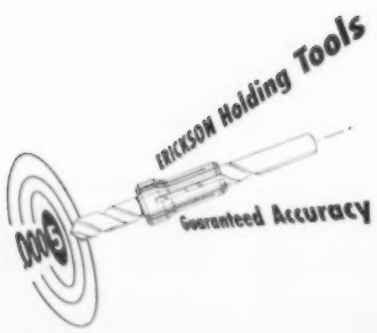
What's more, ease of operation greatly reduces set-up time and since Erickson chucks can grip on the flutes, you can stub your drills . . . extend tool life . . . maintain accuracy.

Send for new Catalog K today! It gives the complete Erickson story. You'll find many interesting applications for all Erickson holding tools.

A-9592

ERICKSON TOOL COMPANY 2303-0 Hamilton Ave., Cleveland 14, Ohio

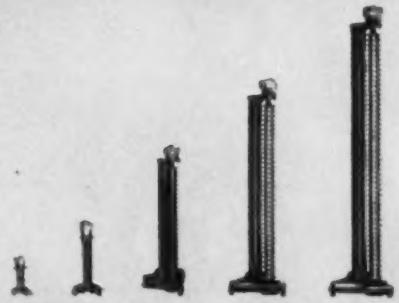




COLLET CHUCKS • FLOATING HOLDERS
TAP CHUCKS • TAP HOLDERS • AIR-OPERATED
CHUCKS • EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

Cadillac PLA-CHEK

Height gage and micrometer settings are 5 to 20 times faster with Cadillac PLA-CHEK than with other methods of comparable accuracy. Less than 15 seconds establishes *any* dimension within a 24″ range to limits of less than .0001″. No auxiliary gage blocks necessary—PLA-CHEK is totally self-contained. Dimensions are taken from the surface plate or from a base line on the work. Send coupon TODAY for complete details!



Cadillac PLA-CHEK Gages are available in a complete range of sizes from the easily portable 6″ and 12″ models for smaller jobs, to 24″, 36″ and 48″ models for larger inspections. Precision-made risers may be used with PLA-CHEK Gages —increasing the range of each 6″ to 12″.

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN

Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Cadillac
GAGE COMPANY
P. O. BOX 3806 • DETROIT 5, MICHIGAN

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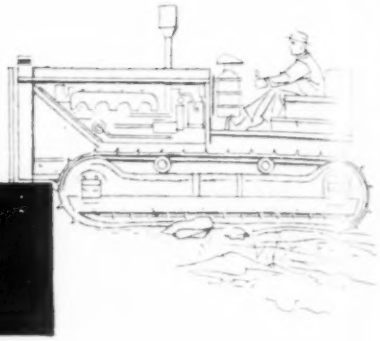
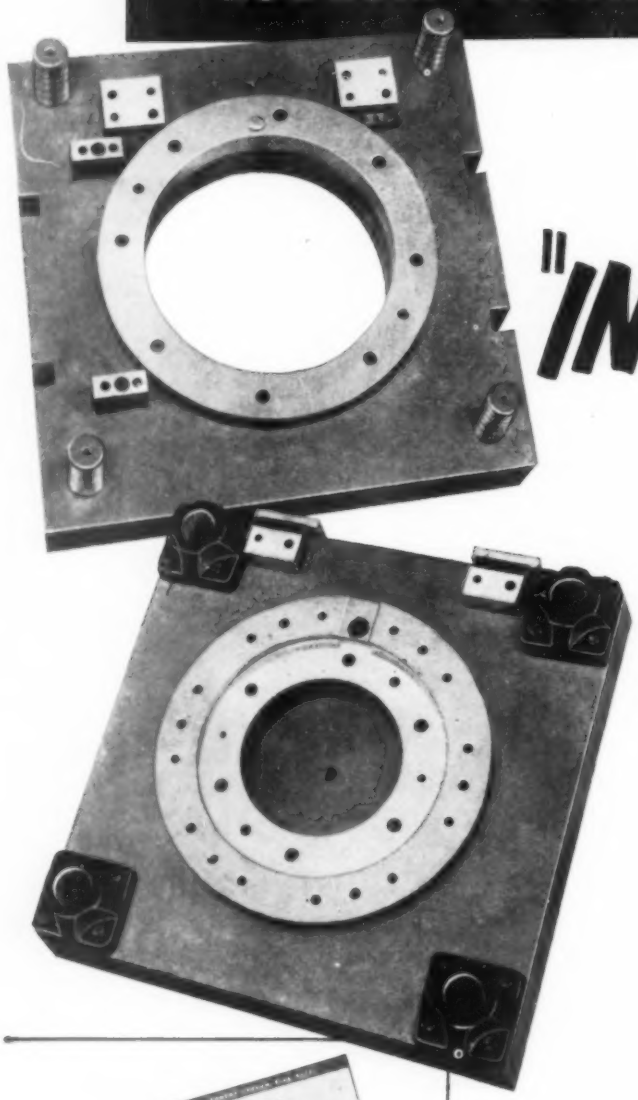


LUDLUM ONTARIO DIE



comes through

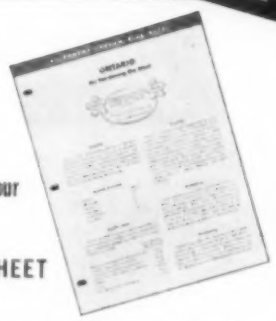
"IN THE CLUTCH"

A NATIONALLY KNOWN TRACTOR COMPANY used Ludlum ONTARIO dies to help reduce production costs. Ontario was given the job of blanking clutch plates from *high carbon* hot rolled steel .084" to .098" thick and 13½" wide.

EACH ONTARIO DIE BLANKED 220,000 clutch plates a year with only 11 resharpenings for an average of 20,000 pieces per grind!

AIR HARDENING ONTARIO PROVED IDEAL for this application because of its high abrasion resistance, high hardness and excellent non-deforming properties. It is tougher and easier to machine than higher carbon-high chromium types which are normally oil hardening.

ALLEGHENY LUDLUM METALLURGISTS can help solve your tool and die steel problems. Call your local A-L representative or distributor today . . . or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.*



Write for your ONTARIO BLUE SHEET

This four page report discusses properties and characteristics of Ontario. It includes complete information on forging, annealing, tempering, etc. and detailed laboratory data on physical characteristics. *Ask for your free copy.*

Address Dept. TE-58

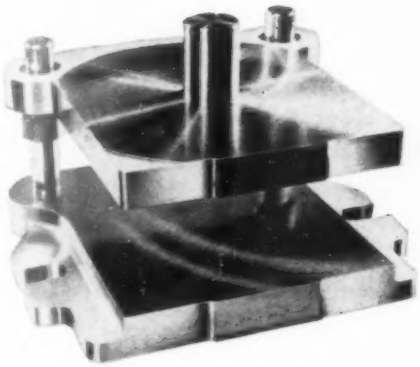
For complete **MODERN** Tooling, call

Allegheny Ludlum

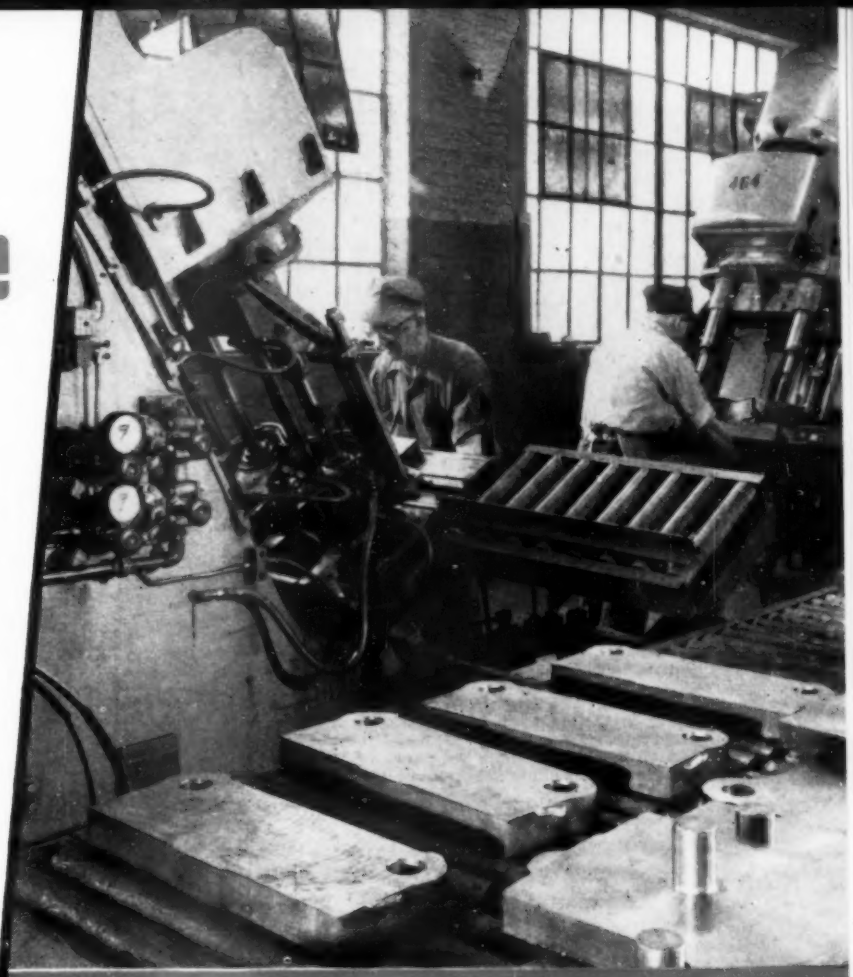
WAD 8331

AL® FINE TOOL STEELS SINCE 1854

Fastest
die set service
ever



. . . made possible by Danly's unique mass-production and distribution system.



At the main Danly plant . . . high speed precision drilling. Interchangeable fixtures accommodate the full range of standard die set sizes.

your Danly Branch plant . . . shipping die sets to ur order. Up-to-date procedures and facilities sure fastest delivery.

To make your tooling program move faster, Danly mass produces interchangeable, precision die set parts . . . stocks them at your local Danly Branch ready for quick assembly to your order and delivery to you. With Danly, from the time you place your order until the set is delivered to you is a matter of only a few days. This extra fast delivery starts at the main Danly plant in Chicago where two complete high-speed production lines turn out a wide variety of precision die set parts. Held in ample stock by your local Danly Branch, these interchangeable parts are assembled to your order and delivered immediately. Don't let lagging die set delivery bog down *your* tooling program. Order from your Danly Branch and get the fastest service . . . ever.

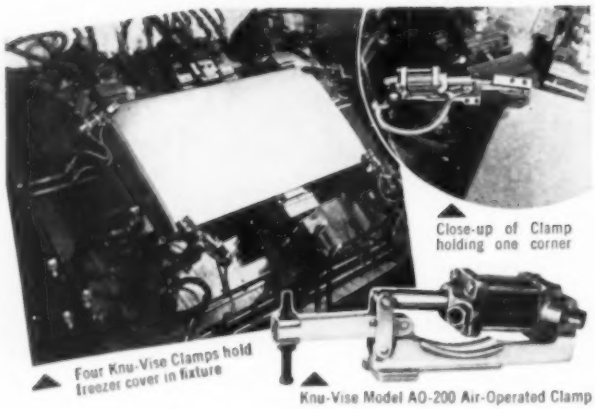
DANLY®

LY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois

Fast, nationwide delivery from these branch plants

*CHICAGO 50	2100 South Laramie Avenue
*CLEVELAND 14	1550 East 33rd Street
*DAYTON 7	3196 Delphos Avenue
*DETROIT 16	1549 Temple Avenue
*GRAND RAPIDS	113 Michigan Street N.W.
INDIANAPOLIS 4	5 West 10th Street
*LONG ISLAND CITY 1	47-28 37th Street
*LOS ANGELES 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 East Wisconsin Avenue
*PHILADELPHIA 40	511 W. Courtland Street
*ROCHESTER 6	33 Rutter Street

*Indicates complete stock



Close-up of Clamp holding one corner

Four Knu-Vise Clamps hold freezer cover in fixture

Knu-Vise Model AO-200 Air-Operated Clamp

Air-Operated Toggle Clamps in Automation

Here is a good example of how an air toggle clamp fits into the automatic sequence of piercing and notching. Four Knu-Vise air operated toggle clamps, Model AO-200, are used to clamp and release a large freezer cover automatically, increasing efficiency and economy. Failure of air pressure will not release the clamps, thus eliminating a possibility of scrappage. This operation is a daily performance at Ben-Hur Mfg. Co., Milwaukee, Wisc., and is only one of the many applications to increase production there and in scores of other industries. Perhaps there is a clamping method in your plant that we can make easier and faster. Send for catalog.

Sales offices in principal cities—Teletype DE 49

KNU-VISE PRODUCTS **LAPEER MFG. CO.**

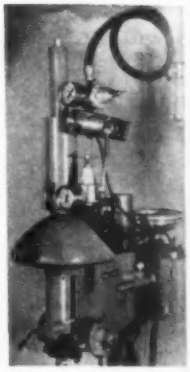
3004 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIVISION: 422 MAGNOLIA, GLENDALE, CALIF.
CANADIAN DIVISION: HIGGINSON ENGINEERING, HAMILTON, ONT.

USE READER SERVICE CARD; INDICATE A-10-270-1

ROTAFEED AUTOMATIC POWER FEED

makes 2,000,000 DRILL PRESS FEEDS *obsolete!*



Attaching directly to the spindle, ROTAFEED produces more holes per hour than any other type of feed. Lower air consumption further "sweetens" the profit picture. Increase your profits by installing or replacing with ROTAFEED, the world's fastest feed for drill presses.

Completely automatic, the ROTAFEED package includes solenoid valve, pressure regulators and gauges, filter-lube unit, air hose with fittings and electrical controls.

A Pneuma-Draulic engineer is ready to assist you.

THE PNEUMA-DRAULIC COMPANY
Box 666, Detroit 6, Mich.

USE READER SERVICE CARD; INDICATE A-10-270-3

YOU! *Need a* BARKER MILL *if you*

$295.00
Base Price with 1/3 H.P. Motor

Accessories at Extra Cost

do Milling, Profiling, Drilling, Key Seating, End Milling, Straddle Milling, Slotting, Turning, Facing, Counterboring & Recessing

in any of your Production Operations

Just think of it—Hundreds in use and not one complaint. REPEAT ORDERS comprise 50% of our present business TODAY.

Manufactures in many industries throughout the country are realizing the many production advantages offered by this precision-built bench mill.

Write for literature and NAMES OF USERS IN YOUR FIELD.

BARKER ENGINEERING COMPANY
500 GREEN ROAD • CLEVELAND 21, OHIO

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MAYLINE

4 POST TABLE WITH DRAWERS

Quality and Price! outstanding features of MAYLINE Products

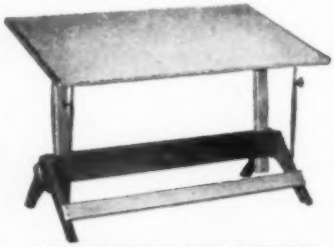
Symbol of MAYLINE Superiority

High quality and fair price identify Mayline drafting furniture and equipment.

Choose from a complete line of 4-Post or Pedestal style Tables—Plan Files in Steel or Wood—accurate T-squares and Straightedges—Stools.

Call your local Dealer.

PLAN FILE WITH HINGED COVER



V-MODEL TABLE WITH FOOTREST

MAYLINE CO.
formerly
ENGINEERING MFG. CO.
611 No. Commerce St.
Sheboygan, Wisconsin

MAYLINE

USE READER SERVICE CARD; INDICATE A-10-270-4

UNION

Accuracy...

American "long rifles" of the 19th century, like the one shown here, pioneered in the true accuracy of small arms.

Among all modern cutting tools, those produced by Union are outstanding in their uniform quality, precision and long life.

Hammer and trigger guard of a percussion match rifle built about 1845 by Morgan James of Utica, New York.

REAMERS

Hand
Jobbers
Carbide
Expansion
Center
Shell
Rose Chucking
Chucking
Taper Pin
Helical Flute
Finishing
Roughing
Bridge & Boiler
Stub Screw
Machine

TWIST DRILLS

END MILLS

HOBS

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OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
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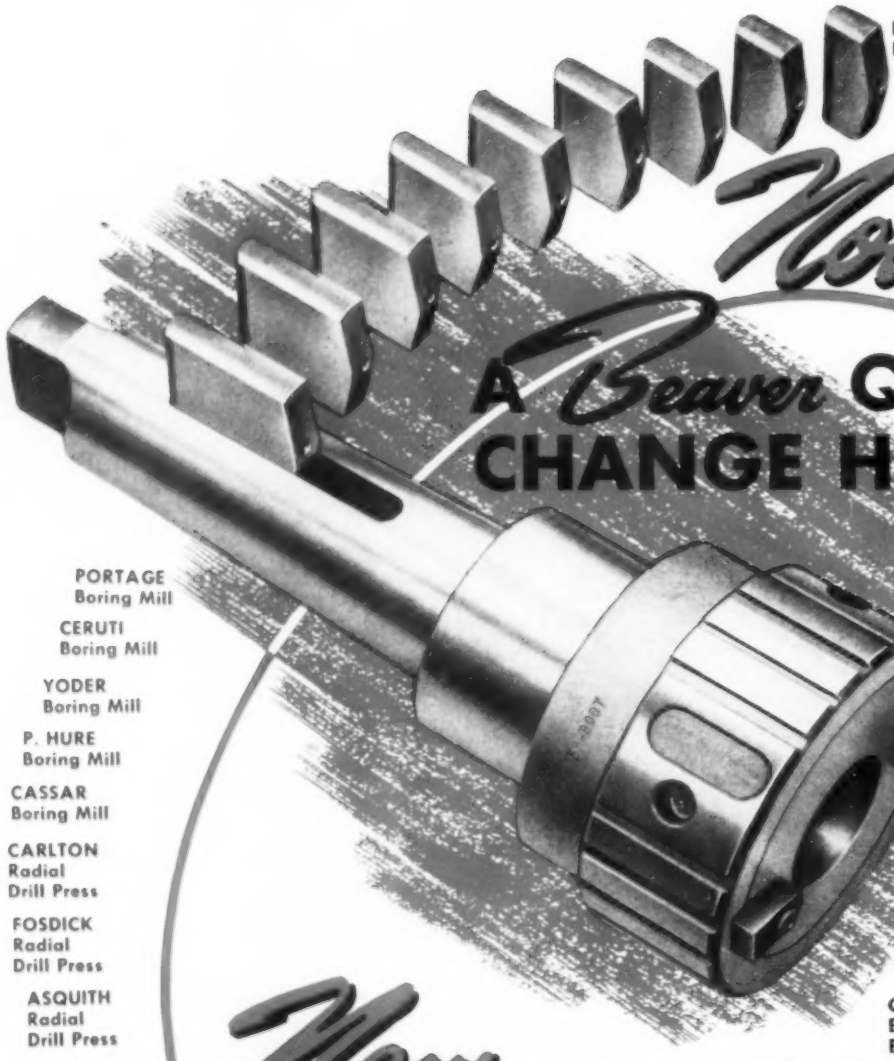

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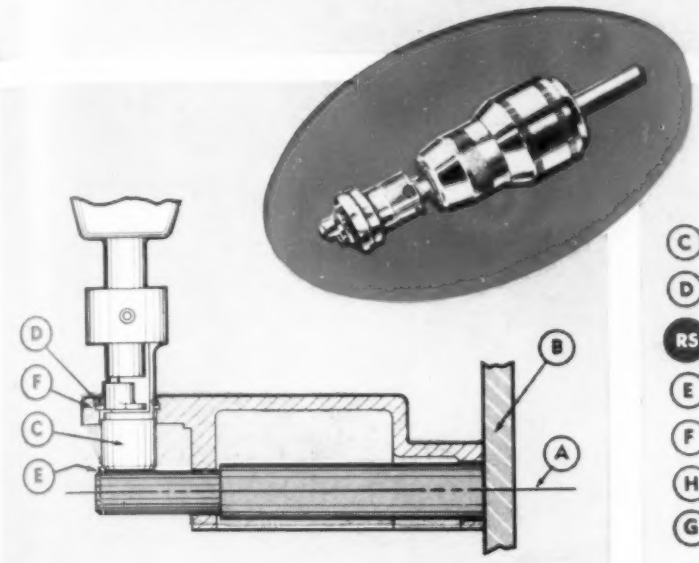
New adaptable Morse Taper Shank and Adaptor Plug

With this new shank and adaptor plug Beaver has developed a holder that is adaptable with the proper plug to 98% of American and foreign made machine tools equipped with No. 5 or No. 6 Morse Taper Sockets.

Beaver TOOL AND ENGINEERING CORPORATION

BOX 429, ROYAL OAK, MICH., Teletype - Big Beaver 648

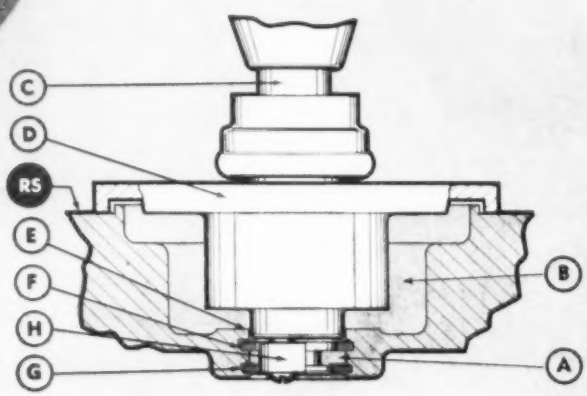
Waldes Truarc grooving tool solves tough internal grooving problems, cuts costs in assembly-line production



Problem: Locating a Groove From Centerline of a Hole A.

(a) Workpiece is fitted into plug on fixture plate *B*.

(b) Bottom adaptor **C** on standard Waldes Truarc Grooving Tool is piloted into bore **D** and registers on side of plug **E**. Groove **F** is cut in exact location required.



Problem: Cutting Two Grooves—One Rectangular, One Beveled—Located In Bore *A* In Large Cavity *B* of Workpiece, and Located From Reference Surface *RS*.

(a) Waldes Truarc Grooving Tool is fitted with elongated spindle assembly **C** and special bushing **D** which spans large cavity permitting tool to register on reference surface ***RS***. Bushing also pilots tool into counter-bore at ***E***.

(b) Both grooves ***F*** and ***G*** are cut simultaneously with special form cutter ***H*** having both required contours.

AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

WIDE CUTTING RANGE! The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in housings with diameters from .250 to 5.00 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

SEND YOUR PROBLEMS TO WALDES! Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.

WRITE *NOW* FOR 20-PAGE MANUAL CONTAINING FULL INFORMATION ON WALDES TRUARC GROOVING TOOL

WALDES

TRUARC

REG U S PAT OFF

GROOVING TOOL

MADE BY THE MANUFACTURERS OF
WALDES TRUARC RETAINING RINGS.
WALDES KOHINOOR, INC., 47-16 Austel Place, L. I. C. 1, N. Y.

WALDES TRUARC GROOVING TOOL MANUFACTURED UNDER U. S. PAT. 2,611,626

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

Name _____

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Company _____

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TE-105 ★

SWEDISH STEELMAKER STILL GOING STRONG

two basic resources: high-grade Swedish ore, over 200 years' experience

Uddeholm is one of Sweden's leading producers of fine steels. Although an iron works was set up at Uddeholm as early as 1668, the company got its real start in the 1700s. The growth that began then still continues. Today, Uddeholm owns mines, ferro alloy works, and modern mills, as well as power stations to run them and railroads to connect them.

Impressive, yes. But for the fine quality of Uddeholm steels two other factors are more important: the natural purity of the ore we use and the craftsmanship and skill acquired in over 10 generations of specialty steelmaking.

Uddeholm Swedish tool steels are marketed in the United States by the Uddeholm Company of America. Large stocks for all hot and cold work applications, in an unusually wide range of sizes, are carried in New York, Cleveland, and Los Angeles.

FREE—STOCK LIST OF UDDEHOLM TOOL STEELS

UDDEHOLM, 155 East 44th St., New York 17, N.Y.

Please send me_____tool steel stock lists.

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VISIT US, BOOTH 201, AT THE NATIONAL METAL EXPOSITION, CHICAGO, NOVEMBER 1ST TO 5TH.

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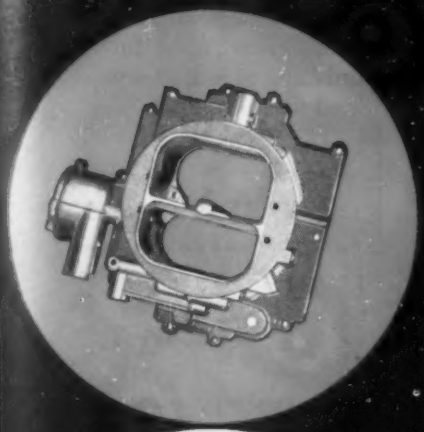
DRILL-SPOT FACE-COUNTERSINK-REAM-TAP

20
individual operations



...on one Part
...on one Machine
...in ten Seconds!

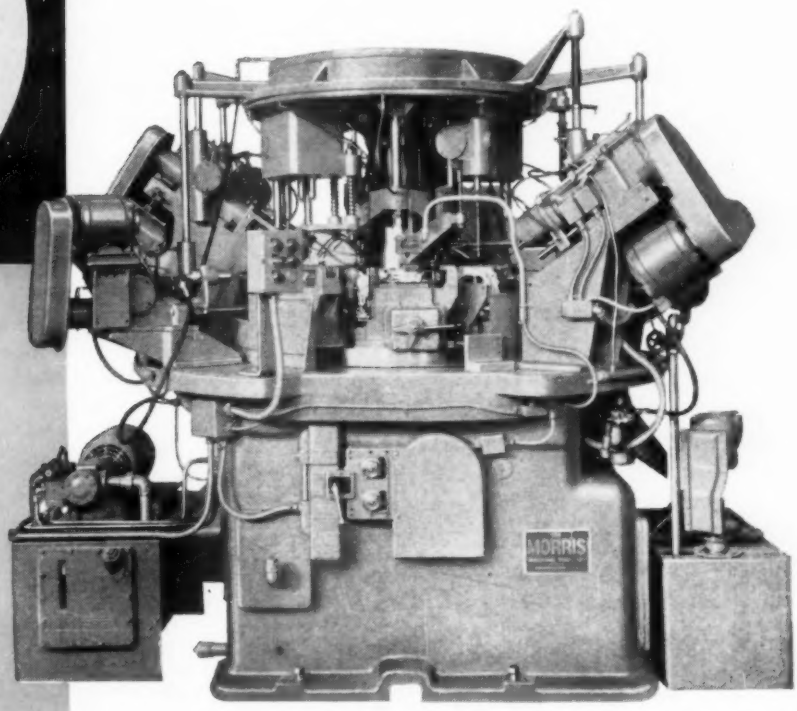
...that's precision production on a Morris
MOR-SPEED Machine

It's easy to say "the way to higher production and lower costs lies in special machinery." The sky-high price and limited application of a "special" often makes this solution impractical.

But Morris Engineers have developed a time-tested method for delivering precision production at lowest cost . . . *without* a staggering investment. Morris MOR-SPEED Machines combine *standard* machine units in a special design that offers all the advantages of "special machinery" without the big price tag.

The machine illustrated is a good example: standard base, standard indexing table, standard center column, standard straight and angular drilling heads, standard coolant and hydraulic units plus a minimum of special tooling. The result is "special" machine production at a very special, low cost.

Your drilling, tapping, reaming and similar operations may be adaptable to a MOR-SPEED solution. It costs you nothing to find out! *Write today for complete details.*



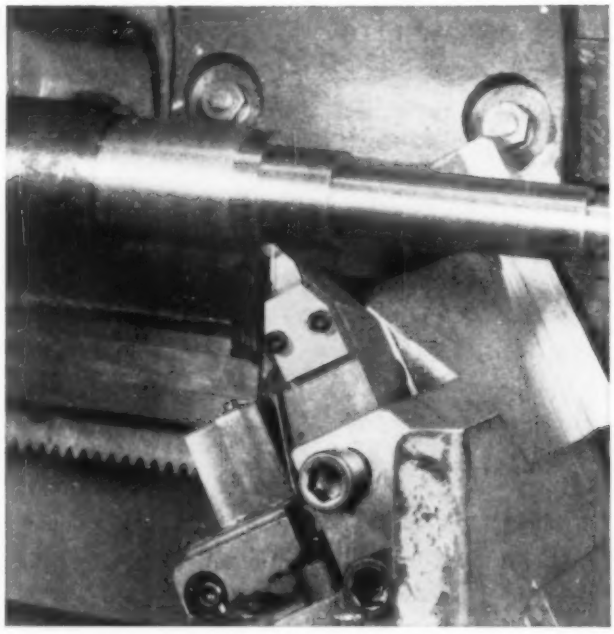
Ask your Morris representative for details on our deferred payment plan.

THE MORRIS MACHINE TOOL CO.
950 HARRIET ST., CINCINNATI 3, OHIO

a better product at less cost with precision PLUS production

Morris

. . . a performance report on another Kennametal grade with ideas you can use to cut machining costs



New Kennametal profiling tool, with clamped K4H grade insert, machining pinion gear blank on New Britain + GF + Copying Lathe. The Lathe's hydraulic system operates the copying slide and actuates several automatic functions.

100% increase in surface speed on New Britain +GF+ Copying Lathe with new Kennametal* K4H Profiling Tool

A series of tests were run to determine which tooling would best utilize the performance potential of this New Britain +GF+ Copying Lathe in profiling SAE 8720 steel pinion gear blanks.

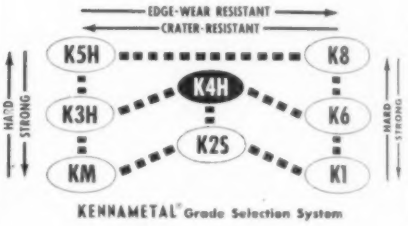
With K4H inserts clamped in new Kennametal PT Style Tools, these tough pinion forgings were profiled at 850 RPM. The machining time averaged 32 seconds, holding plus or minus 0.001 inch on all diameters. The depth of cut on each side was 3/8 inch. An average of 220 pieces were machined per grind.

Prior to testing K4H inserts, the maximum lathe speed practical with standard brazed carbide tools was 425 RPM.

The 100 percent increase in surface speed made possible by the use of K4H inserts permitted fuller utilization of the capabilities of this new, versatile, high speed lathe. A20

*Registered Trademark

K4H is a hard grade with unusually high strength which makes it suitable for roughing scaly, abrasive steel castings and forgings where both edge-wear and crater resistance are required. Versatile K4H is also an excellent grade for interrupted cutting and, when used as a brazed tool, for a variety of finishing operations where the chip load is light.

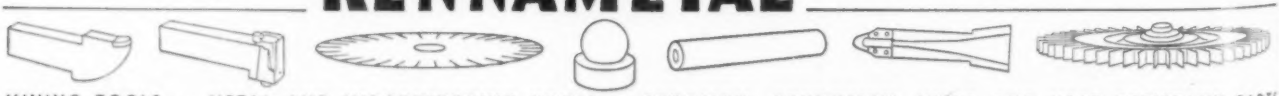


KENNAMETAL® Grade Selection System

The easy-to-use grade selection guide shows that K4H is harder than K2S—more crater resistant than K6—more edge-wear resistant than K3H. It is an intermediate grade having a wide range of application. Where greater edge-wear or crater resistance is desired, performance can be improved simply by changing to the grade indicated on the guide.

Across the country, over 150 Kennametal Tool Engineers are helping plants solve their machining problems by analyzing tool wear—helping select the tool or grade best suited for the job—conducting in-plant training programs. You'll find Kennametal Offices listed in the classified sections of telephone directories in principal cities. Call your nearest Kennametal Tool Engineer, or write to KENNAMETAL INC., Latrobe, Pa.

INDUSTRY AND **KENNAMETAL** . . . PARTNERS IN PROGRESS



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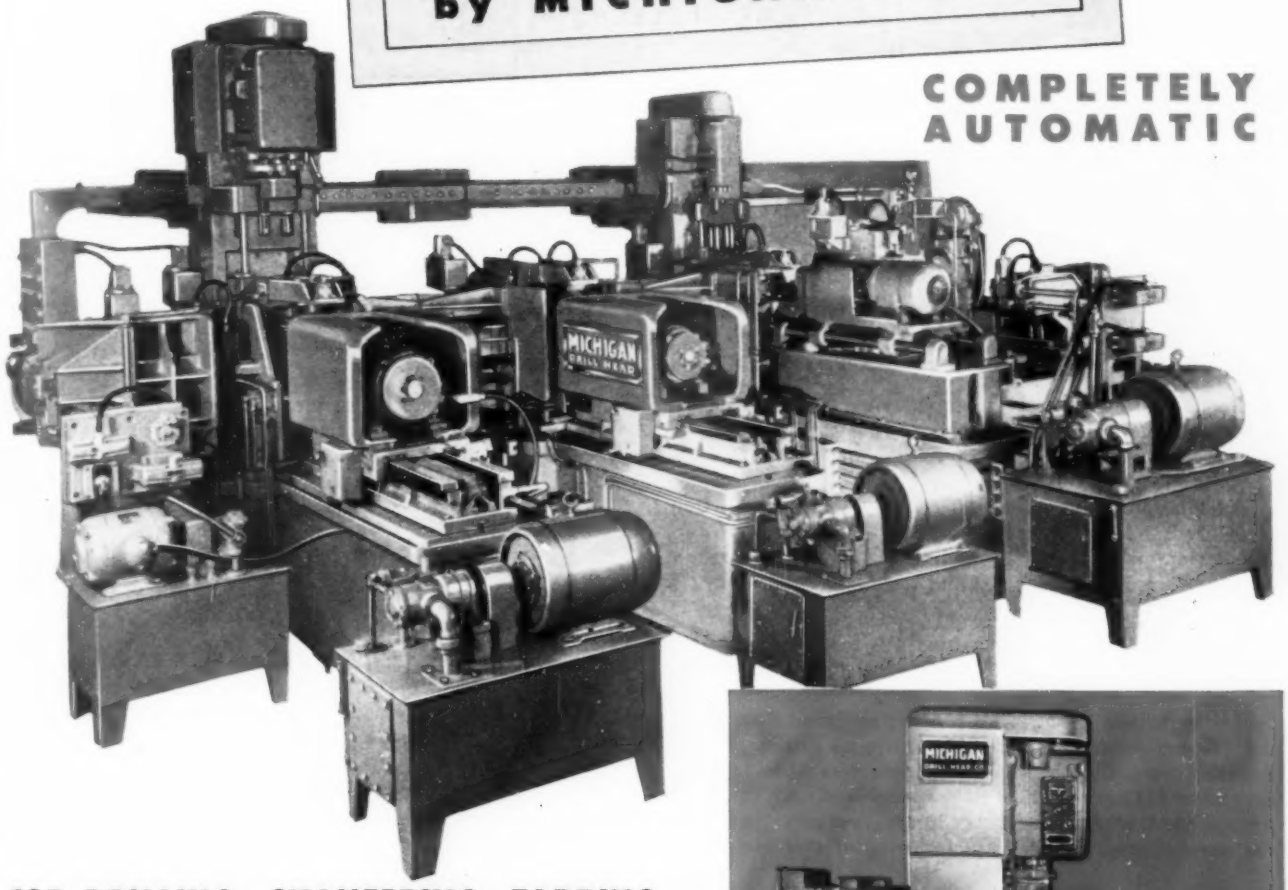
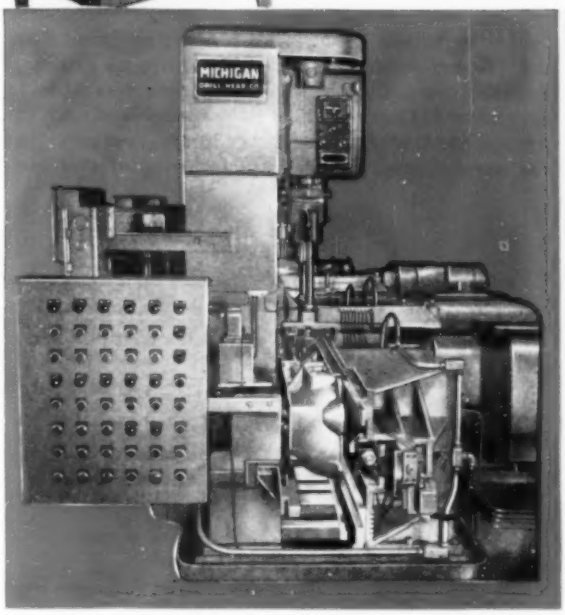
TRANSFER MACHINE
by MICHIGAN DRILL

COMPLETELY AUTOMATIC





FOR DRILLING, CHAMFERING, TAPPING, ROUGH BORING—FINISH BORING

Shown is Four Double End Machine with a transfer System moving Torque Converter Housing automatically through the machine. In addition the part is laid on a roller conveyor after all the machining operations are completed. Machine is designed in such a manner that additional stations can be added at any time. The part, when placed in the transfer track, makes a limit switch and the cycle is automatic.

for faster, More Economical Production

Michigan

DRILL HEAD CO. Detroit 34, Michigan

engineers and manufacturers of production machines and drilling equipment

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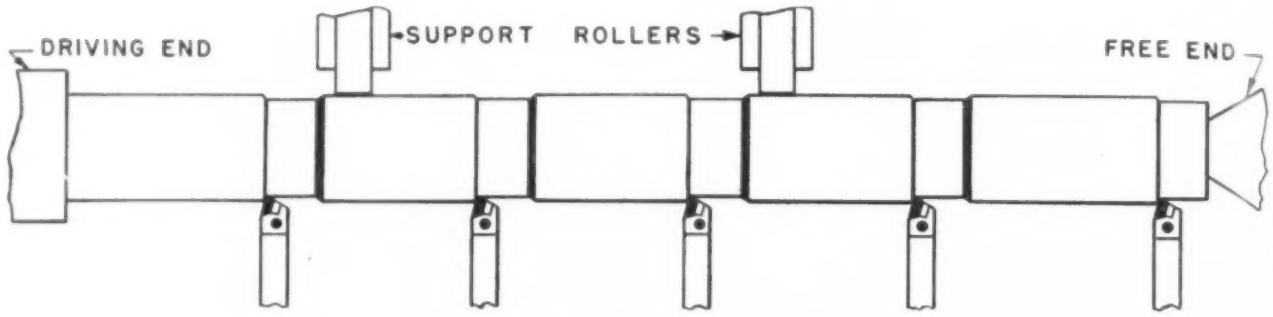
CUTTING COSTS

BY REDUCING TOOLING COSTS



4½ foot long tube used in example shown below.

A well known manufacturer employing Industrial Engineers and emphasizing time and motion study as one of the most important factors for cost reduction and control has been made forcibly aware that the contributing factors of machine and perishable tool costs have been too often overlooked. Now he is doing something about it. He set up a task group whose job it is to effect cost reduction through the use of improved machines and tools.

One of the first jobs this group tackled was the lowering of costs of tools machining a tube 4½ feet long, without changing any of the conditions such as speeds and feeds but by simply replacing the existing toolholders using 1½" long carbide inserts with a newly designed Toolholder and "Throw-Away" Blanks that require no grinding. This manufacturer, by this simple change, was able *to save more than* $144.45 *per* 1000 *pieces machined.* All this was accomplished without any speedup in workers' pace. It was accomplished simply *by a lowering of tool costs.*

Example

By using old Toolholder		By using newly designed Toolholder	
Cost of each carbide ⅜" I.C. triangular (6 cutting edges) insert 1½" long	$ 4.00	Cost of each carbide ⅜" I. C. triangular (6 cutting edges) "Throw-Away" blank	$ 1.01
Cost of 10 regrinds at $2.00 each furnishing 60 cutting edges	20.00	No regrinding required with "Throw-Away" blank	0
		Cost of 10 additional "Throw-Away" blanks furnishing 60 cutting edges	10.10
Total cost of carbide and grinding	24.00	Total cost of carbide (no grinding)	11.11
Number of stations	5	Number of stations	5
Total cost	$120.00	Total cost	$55.55
Number of components	600	Number of components (note number of pieces has been increased from 600 to 1000)	1000
Cost per component	.20	Cost per component	.05555
Cost per thousand pieces	$200.00	Cost per thousand pieces	$55.55

Savings—$144.45 per 1000 pieces

The cost of the five newly designed toolholders involved is $125.00. Here is an instance of where an accessory almost paid for itself in the first five days of its use.

If this had come by accident it would have been considered a miracle. It did not; it was planned as a deliberate goal by the manufacturers of carbide and cutting tools.

All five Toolholders are Vascoloy-Ramet Style TBTR using ⅜" Inscribed Circle V-R Grade E. "Throw-Away" Blanks.

They were aware that something had to be done to effectively reduce tool costs and after four years of development, trial and investment in precision equipment they have launched what appears to be the greatest saving in machining, both in actual costs and time consumed in machining, since the introduction of carbide itself as

Triangular, Round and Square precision "Throw-Away" blanks for the new Toolholders. Precision "Throw-Away" Blanks are ground all over and are used where precision indexing is desired. Utility "Throw-Away" Blanks, ground on two faces only, are also available in Triangular and Square blanks.

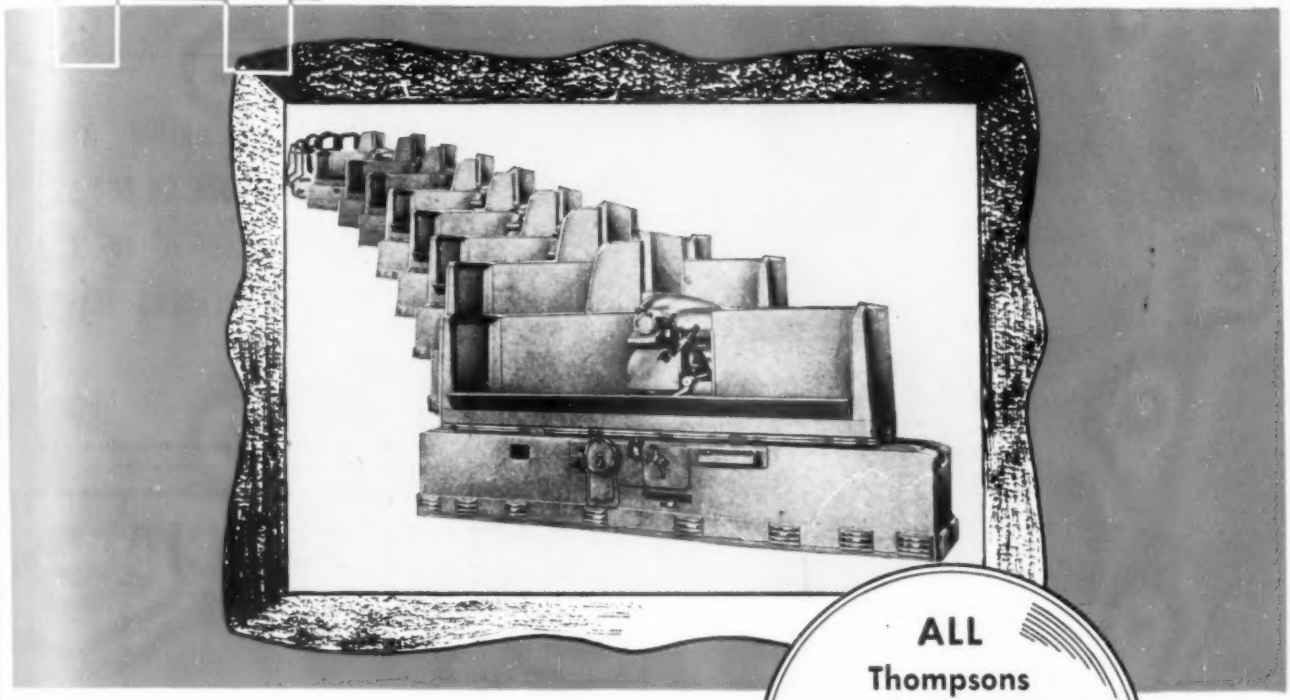
a cutting tool. If you wish the name of the firm whose case history is outlined above and more details about the cutting tool and "Throw-Away" Blanks write today—

VASCOLOY-RAMET CORPORATION
854 Market Street
Waukegan, Ill.

LOOK CLOSELY AT THIS PICTURE
OF GRINDER PRODUCTION AND SEE WHY...

14 *is a lucky number*

for a manufacturer requiring precision grinding



ALL Thompsons operated continuously with much LESS DOWNTIME

thats why

it will pay you to invest in

Thompson Grinders

After twelve years continuous manufacture of precision ground products, ten Thompson Surface Grinders proved so efficient and economical that this manufacturer ordered four more machines.

Thompson Grinders are available in a wide range of types and sizes from 6" x 18" to 72" x 384" to meet all production, special or tool room grinding requirements. The Thompson line includes machines from giant Hydrial Way Grinders to automatic Truform Jet Blade Contour Grinders, Dual Rotary Grinders and Broach Grinders.

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REDUCE COSTS WITH CADMET INVESTMENT CASTINGS

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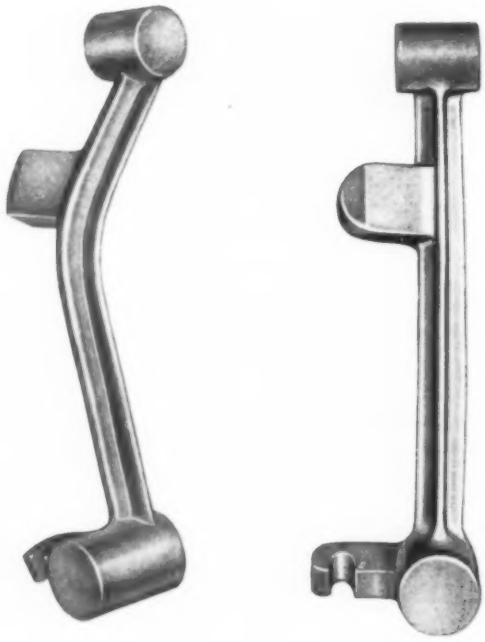

CADMET INVESTMENT CASTINGS by the Lost-Wax Method when properly applied, represent a distinct saving in material and machining time.

CADMET CASTINGS find their best application in small intricate parts, which when made by the conventional methods require extensive and costly machining operations.

CADMET CASTINGS can be made in a wide range of alloys including carbon, alloy and stainless steels, as well as bronze, aluminum and Beryllium Copper.

Send us your prints and specifications today and you can be assured of a prompt reply.

Ask for our free literature on Why's and Wherefore's in the INVESTMENT CASTING BUSINESS.

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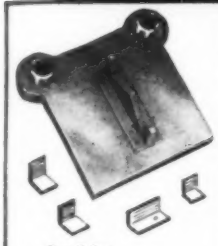
Punches and Dies



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Angle Iron Cut-Off Die

Mounted in leader pin die set. Fits most all makes of 25-ton and larger presses. Simple shearing action insures straight, clean cut WITHOUT DISTORTION. Just one of our many standard stock-dies.

Capacity: 2"x2"x¾"

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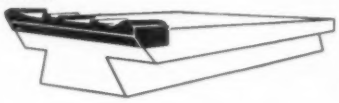
QUICK SPECIALS in CARBIDE

TUNGSTEN CARBIDE TIPPED FLAT FORM TOOL



T. C. TIPPED CIRCULAR FORM TOOL

THIS TUNGSTEN CARBIDE TIPPED DIE IS ANOTHER EXAMPLE OF A FORM CUTTING TOOL PRECISION MADE FOR SPECIAL ADAPTATION.

FORM TOOLS
CUTTERS
PUNCHES
DIES
POWDER MOLDS

Form cutters (any size or style) can be made to your order promptly at B-M-S where many new uses of carbides have resulted from PIONEERING and experience. *Write for new catalog.*

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"PRECISION IN CARBIDES AND STEELS SINCE 1935"

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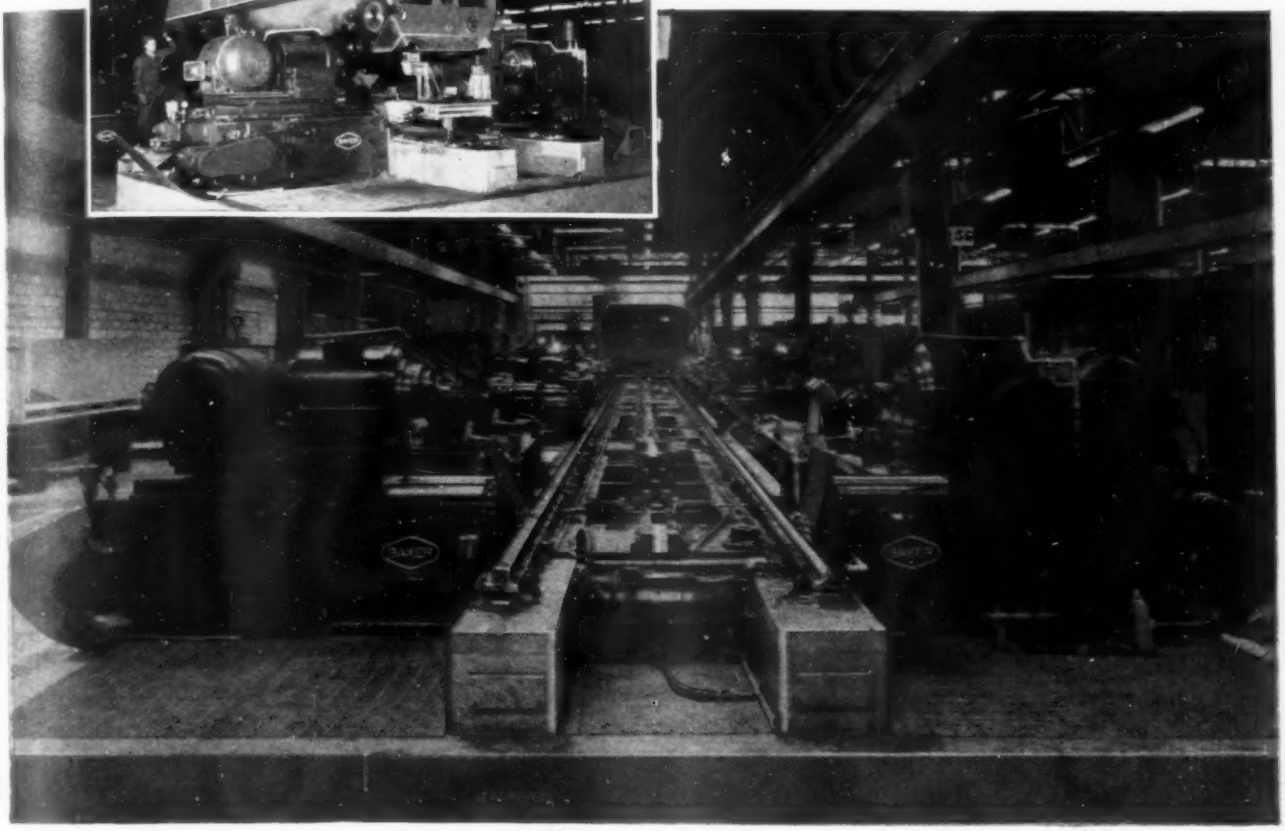
New BAKER Automatic MACHINES 15,000 lb. TANK HULL as it passes along 100 FOOT RAILS!



OPERATIONS: DRILLING . . . TAPPING . . . BORING . . . FACING on 102 holes . . .

10 main bores Mounted on a specially-built floating concrete slab, this huge new Automatic Baker Transfer Machine accurately performs multiple drilling, tapping, boring and facing operations on 15,000 pound rough weldments 9 feet wide and 16 feet long. Savings achieved in production costs with a machine of this type are tremendous. Baker engineering know-how stands ready to solve your production problems . . . with cost cutting standard or special, single or multi-operation machines.

Write regarding your specific job problems . . .

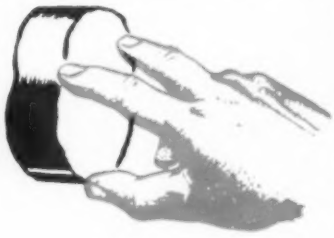
BAKER BROTHERS, INC. Toledo, Ohio

DRILLING . . . TAPPING . . . KEYSEATING and CONTOUR GRINDING MACHINES

WOODWORTH'S

New Universal Clamping Fixture

THE "FINGER" CHUCK



The Woodworth "Finger" chuck can be used in many *end* or *face clamp* applications. It will compensate for irregular shapes of surfaces and allows distortion-free chucking of frail cross-section parts. In its operation, it features the Woodworth patented "tilting piston" design and the fingers are opened by a built-in air cylinder. Clamping pressure is achieved by controlled compression springs.

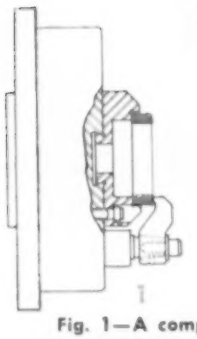
The "floating fingers" compensate for irregularities in the clamped face. Movement is forward 3/8" on each finger and rotation is clockwise in a full 90 degrees for freedom of part removal.

The "floating finger" chuck can also be used in a vertical position for milling, drilling, surface grinding, honing and many other machining operations.

Thin-walled parts can be centered in a finger chuck with a diaphragm type locater either internally or externally. Then the part can be face-clamped.

The "finger" chuck will be available in light duty, high speed models (500-4000 RPM) and heavy duty, low speed models.

Quick change-over from one part to another is possible with the use of Woodworth Designed *centralizing locaters or nests* plus a set of custom made fingers. All locaters are designed to suit the basic chucks. The sizes of the basic chucks are: 7, 10, and 13" diameter.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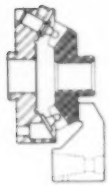
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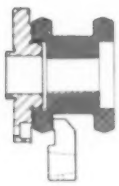
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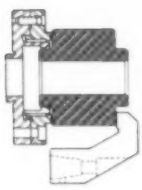
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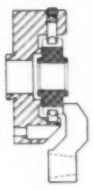
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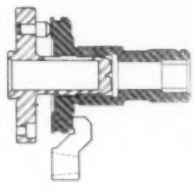
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Fig. 1—A complete assembly including pot locater and clamping fingers for a thin-walled part. Adapter plates can be made for any type of spindle mount on application.

Fig. 2—Ball pins locate this bevel gear on the P.D. of the gear for a finish bore operation.

Fig. 3—A flanged casting is held for boring, facing, and counterboring. Part is centered by a pilot on the locater plate. Clamping is achieved on one flanged face (this surface has not been machined).

Fig. 4—A bulky forging is held by these extended clamping fingers for a boring operation on the I.D. Centering is achieved with a reverse diaphragm arbor (an integral part of the locater pot).

Fig. 5—Wedge-type pins locate this spur gear while fingers clamp on face.

Fig. 6—A Push-type arbor locates this part and stop pins are utilized on the machined face, while fingers clamp.

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Webber PRESENTS

The New, All-Purpose, Heavy-Duty 84 Block Gage Set

A COMPLETE GAGING SYSTEM

Here, in a single package, are the 84 gage blocks and the accessories required to constitute a complete gaging system. It will fully meet the exacting requirements of the vast majority of manufacturers of precision products.

Webber Heavy Duty gage blocks are generously proportioned (½" x 1½") in order to insure maximum resistance to wear, with resultant long life. In addition to their normal gaging function, the blocks, used with the proper fixtures, (included in the set) will assemble into dividers, scribers, height or snap gages, thus making them especially valuable for layout or inspection work. When assembled with the required number of six inch blocks, any desired length can be obtained.

84 Block H.D. Set—accuracy, ±.000004", complete with accessories. As illustrated **$575.00**

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6.000" Block with eccentric clamp **$35.75**

Webber GAGE COMPANY

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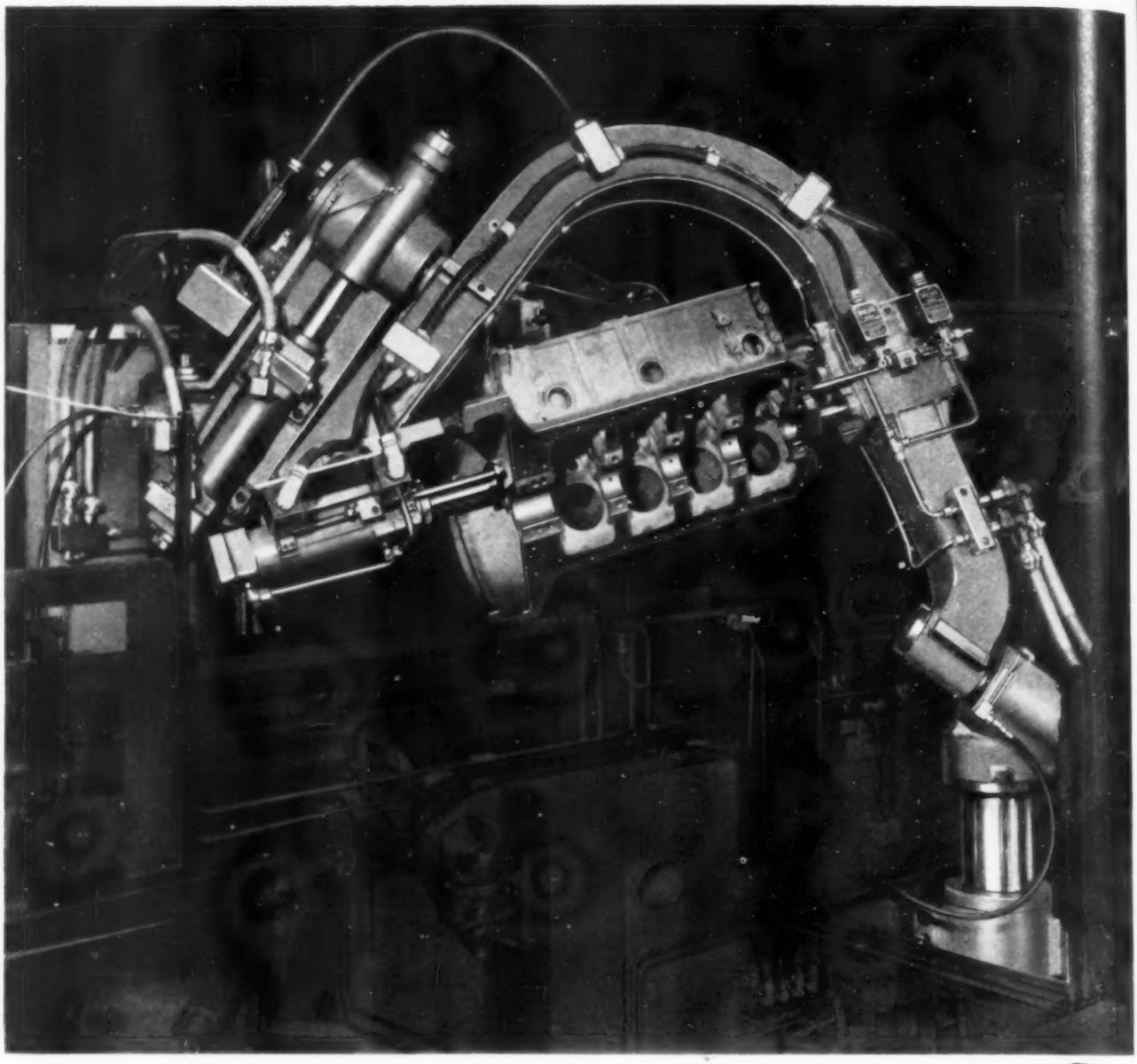
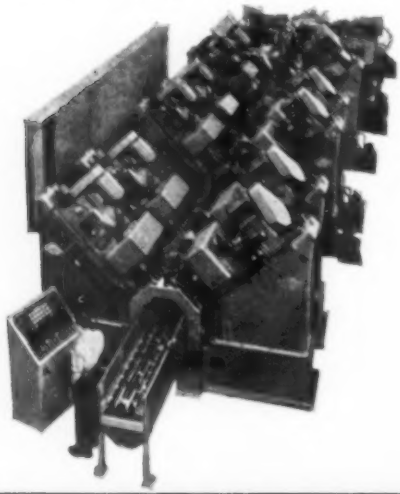
Webber MICRO-ACCURATE Gages

Largest Exclusive Manufacturers of Precision Gage Blocks



Getting at a block from all six sides . . .



Operations on a cylinder block require getting at it from all sides, which in this case means a double 90° turnover at one point in the transfer sequence. Though this called for an unusual "gimmick", Greenlee engineers easily came up with the successful solution — the angularly-pivoted lifting and turning yoke shown above. Yet this is only *one* of the numerous Greenlee features that are making money today for the owner of this Greenlee Special. Thirty-six years of itemized experience can perhaps be of help to you, too . . .

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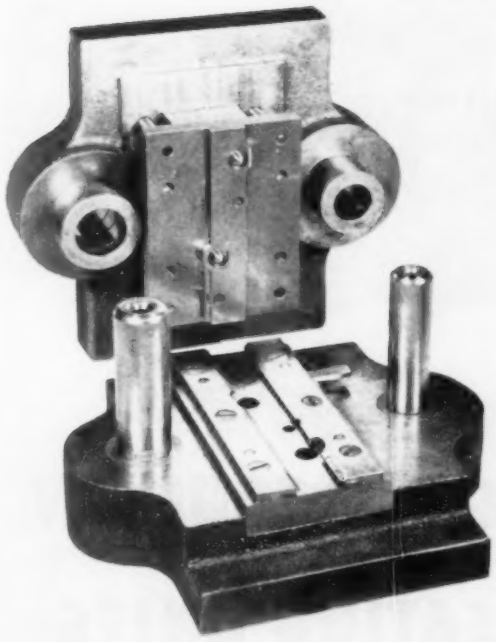
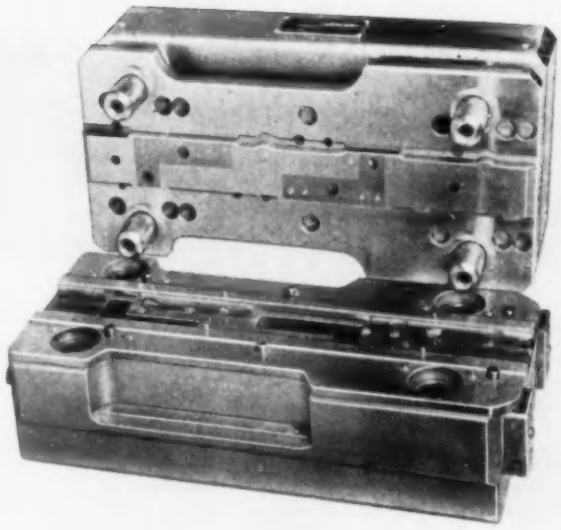
1990 MASON AVE., ROCKFORD, ILL.

PRODUCTION MACHINERY
GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER MACHINES



Simple progressive washer die, used at Precision Spring Company, Detroit, Michigan, pierces and blanks spring-tempered steel washers. With millions of accurate hits per sharpening, this die builds profits by cutting costs.



Complex lamination die punches two high-silicon "L" laminations per stroke. Dies of this type are in use throughout the metal-working industry, outwearing and outproducing steel dies by up to fifty times.

Dies equipped with CARBOLOY® CEMENTED CARBIDE increase production from 10 to 50 times

Over a wide range of applications, Carboloy cemented carbides have proved their superiority to steel by increasing production and cutting costs.

Here are some of the actual results achieved when users of large and small, simple and complex dies, switched from steel dies to dies equipped with Carboloy cemented carbide:

Lamination die. With Carboloy cemented carbide, production runs averaged 35 times longer than possible with steel.

Pierce and cutoff die. At 400 strokes per minute, carbide-equipped dies produced 2,000,000 strokes without resharpening.

Blanking and drawing die. Carbide-equipped die lasted months before resharpening. Steel required maintenance every week.

Deep drawing die. With Carboloy cemented carbide, manufacturing time per 100,000 pieces was slashed from 70 hours to 52 hours.

Explore the possibilities of using Carboloy cemented carbides in your dies. Carboloy engineers will give you or your die-maker every possible assistance. And, you can have your key men trained at the Carboloy Die School in Detroit.

Carbides are simple to use, easy to maintain. They'll pay for themselves through increased production, fewer rejects, reduced downtime and higher quality.

For complete information or for free Carboloy Die Engineering Manual, send coupon, today.

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DEPARTMENT OF GENERAL ELECTRIC COMPANY

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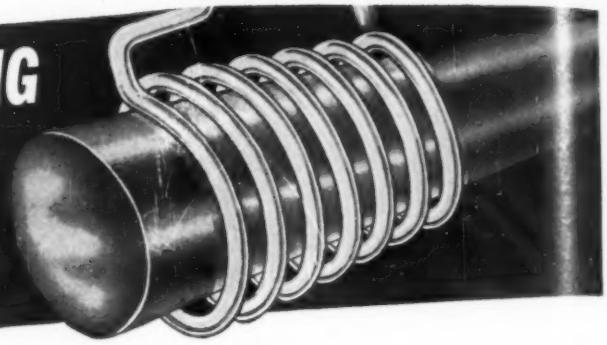
FROM A NEEDLE . . . TO A TURBINE SHAFT
FASTER and BETTER



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Induction
HEATING UNITS

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Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

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The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

2½ KW INDUCTION HEATING UNIT

30 KW INDUCTION HEATING UNIT

100 KW INDUCTION HEATING UNIT

LEPEL Electronic Tube GENERATORS
1 KW; 2½ KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.

LEPEL Spark Gap Converters
2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

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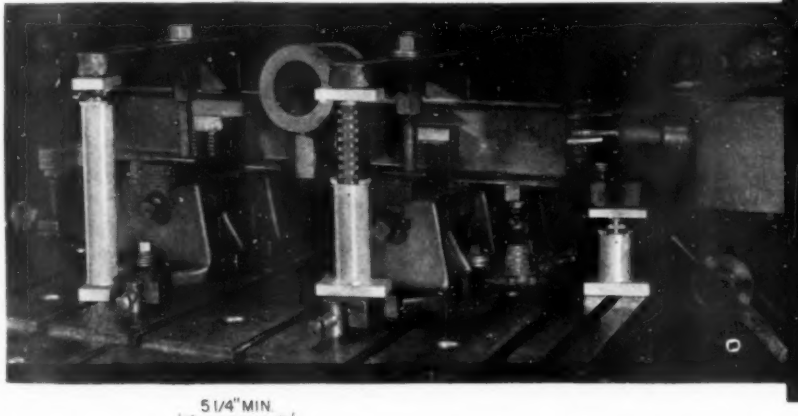
INGERSOLL CLAMP POSTS

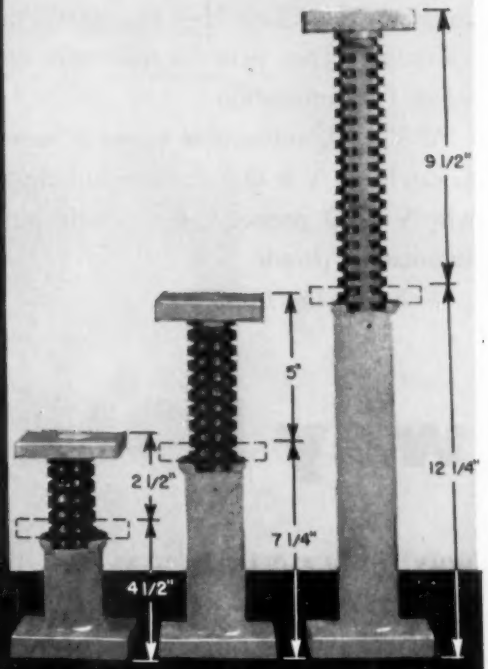
TO REDUCE MACHINE SETUP TIME

Due to repeated requests by machine-shop men, Ingersoll Adjustable Clamp Posts are now being produced and are immediately available from stock at low cost.

Ingersoll Clamp Posts provide rigid support for hold-down clamps, reducing machine setup time for a wide range of milling, boring, planing and drilling operations. Suitable for almost all types and kinds of machines, they eliminate use of makeshift, inefficient setup equipment. Originally developed for Ingersoll's own plant, they have been thoroughly tested and improved during several years of use.

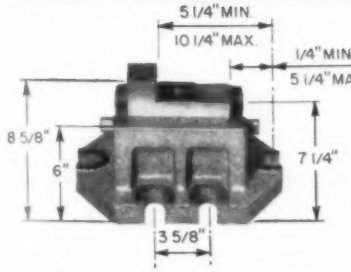
Other Ingersoll setup aids now being manufactured include Ingersoll Chuck Jaws, which hold work securely in position during machining, and Ingersoll Raising Blocks, specially designed to provide a firm, stable footing for workpieces.





4" SIZE	7" SIZE	12" SIZE
$8.50	$12.00	$15.00

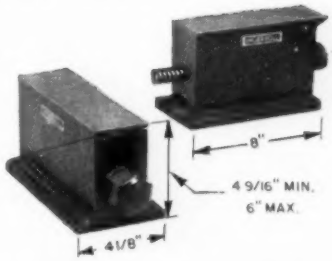
Ingersoll Clamp Posts are made in these three standard sizes. Information on other sizes will be sent upon request. Easily adjustable, they have ½" increments and are raised by simply lifting and turning the stem.



OTHER INGERSOLL MACHINE SETUP AIDS

INGERSOLL CHUCK JAWS
Standard Size as Shown, $135 Each . . . also Made to Meet Special Requirements at slightly Extra Cost.

INGERSOLL RAISING BLOCKS
Standard Size as Shown, $65 Each.



Send your order for Ingersoll Clamp Posts, Chuck Jaws and Raising Blocks today to The Ingersoll Milling Machine Company, Dept. F, 2404 Douglas St., Rockford, Ill.

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ROCKFORD, ILLINOIS, U.S.A.

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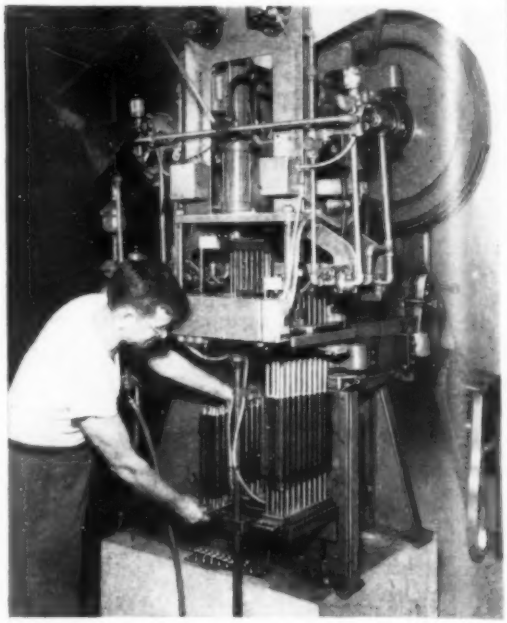
ORIGINATORS OF SHEAR CLEAR CUTTERS

At the York Corporation plant this V & O corrugates, ...inches and flares copper fins; forms spacers; and stacks fins ...n cop... per tubes; all on a single machine.



■ Automation needs exceptionally accurate, sturdy, trustworthy production machines. The high cost tooling and complex accessories do not permit anything less.

V & O has known all this for 65 years. The first V & O presses were designed because no others were adequate for automated tooling. The long slides, hand scraped ways, sturdyized features of V & O presses all were created for automation; all have been time-tested on highly automated operations. Our new controls and devices are designed solely for automation.

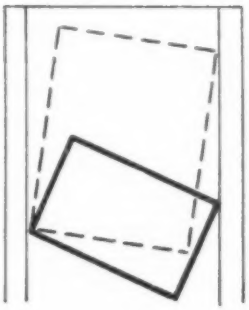
At V & O, automation is not a "new trend" with which to catch up. V & O never has had any other trend. That is why V & O presses can so easily put you ahead of the automation parade.

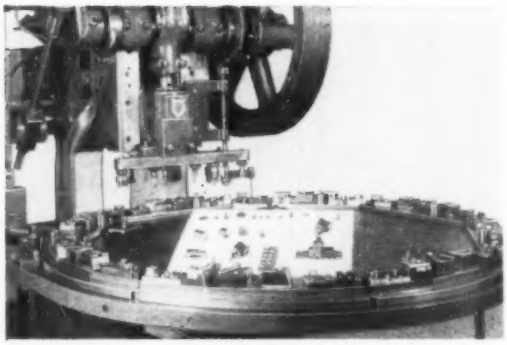
Write for the full story.

why FOLLOW automation?

WHY THE V & O LONG SLIDE PROVIDES BETTER ALIGNMENT

With the same running clearance, the longer the slide the less the possibility for angular misalignment. And we keep our running clearances very close indeed.





Long before the "automation craze" began, this 8 station dial feed V & O assembled the parts shown here, at the rate of 12 assemblies per minute.

THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

HUDSON, NEW YORK

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BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

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V & O is now equipping presses with time-tested pneumatic clutches modified to provide improved economy, compactness and simplicity in press operation. They are unusually long-lived, self-ventilated, and designed to operate indefinitely with minimum maintenance. They increase the advantages of automation — and of better tooling.

To help improve induction heating applications, Lindberg engineers have spent two years developing equipment for M-G set frequencies of 1 kc., 3 kc. and 10 kc. This equipment is now available to you.

This development has also produced many advanced design features that are incorporated in control and heating stations used in connection with motor generator equipment.

Generators are available in power outputs from 30 kw. to 1250 kw.

Lindberg engineers are now equipped to solve your metal heating problems using optimum frequencies for specific applications from 60 cycles upwards. For information consult your nearest Lindberg field office or write for Bulletin No. 1460.

The High Frequency Division of Lindberg Engineering Company announces a complete line of MOTOR GENERATOR EQUIPMENT for all Induction Heating Applications

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in a matter of minutes for increased production—improved quality — and longer tool life with your present machine tools.

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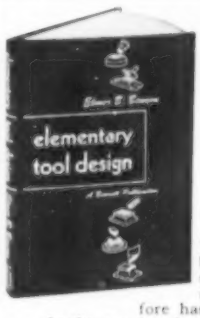

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Only the MAXWELL E-Z Set boring tools feature high speed operation, micrometer-like adjustment to 0.0001-inch and maximum boring range.

Interchangeable shanks permit E-Z Set boring tools to be used in turret lathe, jig-bore, milling machine, boring mill, automatic or other machine tools. Because they can be adjusted for cut in only one-tenth the time formerly required by similar tools, these Maxwell-made tools can meet high-speed production on schedules.

E-Z Set boring tools are available in three models having maximum boring bar capacities of ½, 1 and 1½ inches and covering a boring range of from ⅜ to 20 inches.

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THE MAXWELL COMPANY

251 Broadway • Bedford, Ohio

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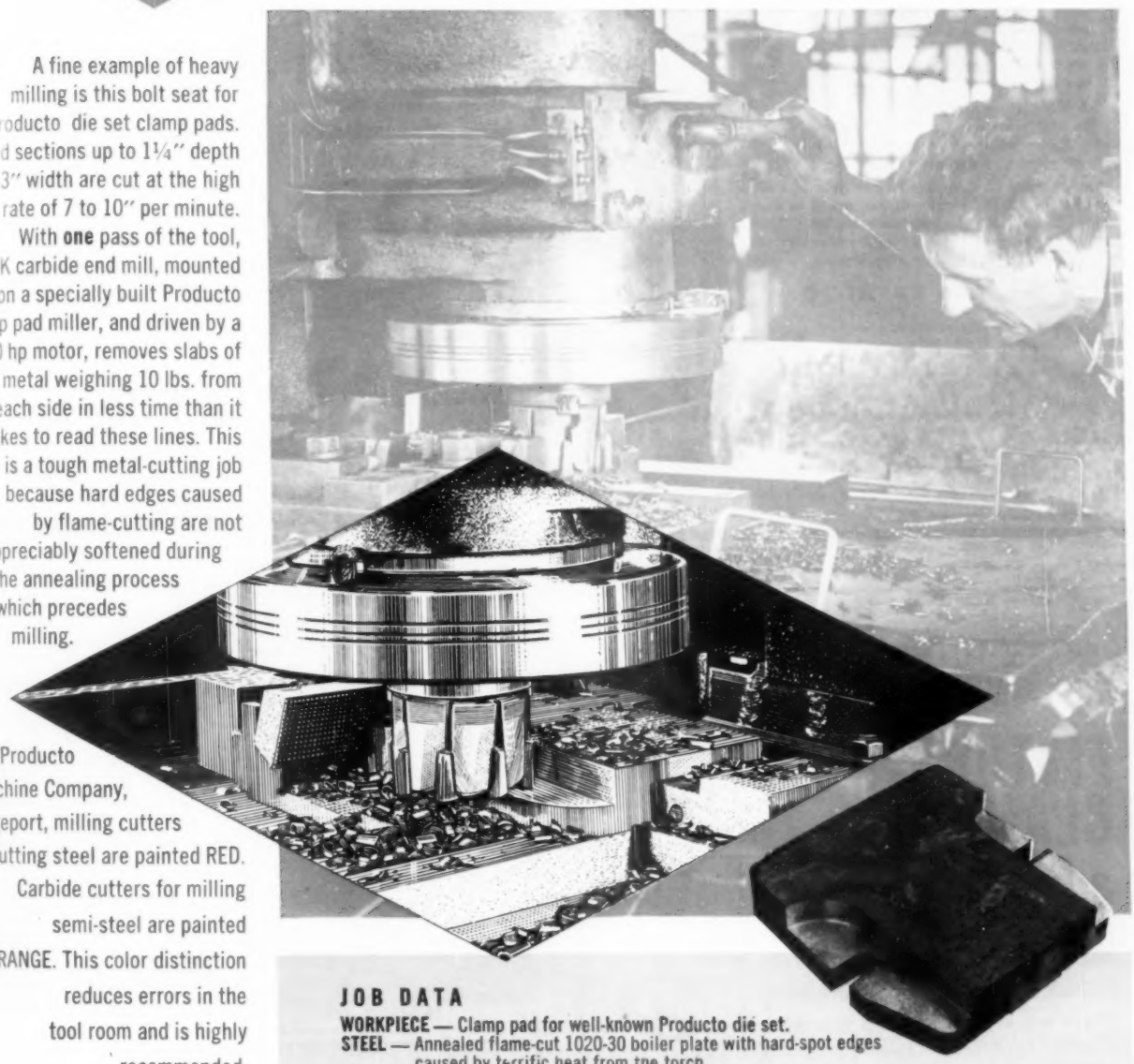
carbide end mill hogs out tough, torchcut 1020-30 boilerplate for Producto Die Sets

A fine example of heavy milling is this bolt seat for Producto die set clamp pads. Milled sections up to 1¼" depth and 3" width are cut at the high rate of 7 to 10" per minute. With **one** pass of the tool, an OK carbide end mill, mounted on a specially built Producto clamp pad miller, and driven by a 30 hp motor, removes slabs of metal weighing 10 lbs. from each side in less time than it takes to read these lines. This is a tough metal-cutting job because hard edges caused by flame-cutting are not appreciably softened during the annealing process which precedes milling.



At Producto Machine Company, Bridgeport, milling cutters for cutting steel are painted RED. Carbide cutters for milling semi-steel are painted ORANGE. This color distinction reduces errors in the tool room and is highly recommended.

JOB DATA

WORKPIECE — Clamp pad for well-known Producto die set.
STEEL — Annealed flame-cut 1020-30 boiler plate with hard-spot edges caused by terrific heat from the torch.
MACHINE — A special clamp pad miller built in Producto's own shop powered with a 30 hp motor.
CUTTER — A 5"-8-blade OK carbide end mill, the only mill found capable of handling this tough job.
RESECTION — A piece irregular in shape varying from 10 to 15" in length, 2-3" in width and up to 1¼" in depth.
FEED — 7 to 10" per minute.

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TWO COMPONENTS— BODY AND BLADES

OK

modern milling cutters for modern milling machines

THE OK TOOL COMPANY, INC., Milford, New Hampshire

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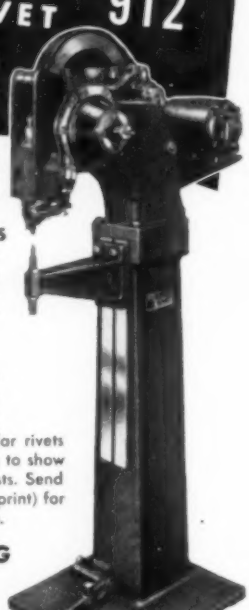
Chicago RIVET "912"
AUTOMATIC RIVET SETTER
CUTS COSTS 3 WAYS



1 FASTENS FASTER . . . Only the speed of the operator limits the 912's riveting speed. Completely automatic. A push on the foot pedal automatically feeds, inserts and clinches the rivet.

2 DOES WORK OF SEVERAL MACHINES Quick change rotary hopper and raceway makes the 912 adjustable in 5 to 10 minutes to set different size rivets. Adjustable anvil height and 12-inch throat provide further versatility.

3 SAVES ON MAINTENANCE . . . The 912 is massively built to stand the shocks of constant use and is designed for quick, easy servicing and parts replacement.

If your assembly calls for 3/16" steel tubular rivets or smaller, of 15/16" lengths or less, ask us to show you how the 912 can cut your fastening costs. Send a sample of your problem assembly (or blueprint) for a free fastening analysis.

FREE CATALOG *contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.*

Chicago Rivet & MACHINE CO.
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Branch Factory: Tyrone, Pa.

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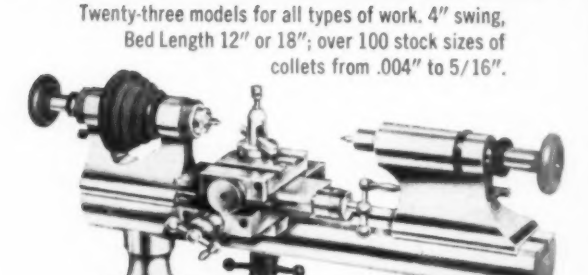

Send for Catalog L describing Lathes for tool work, second operations; turrets and full line of accessories.

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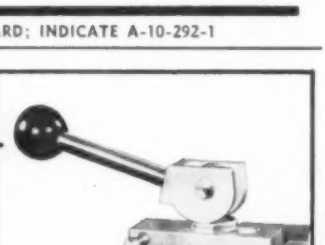

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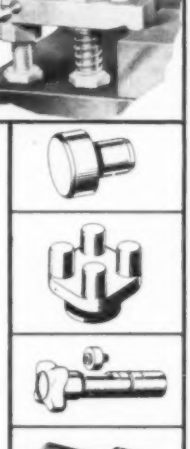

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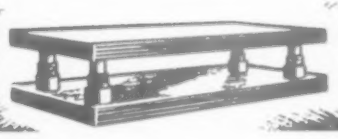
LARGE & SPECIAL  LEMPCO BALL

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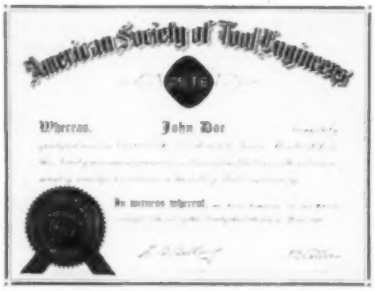

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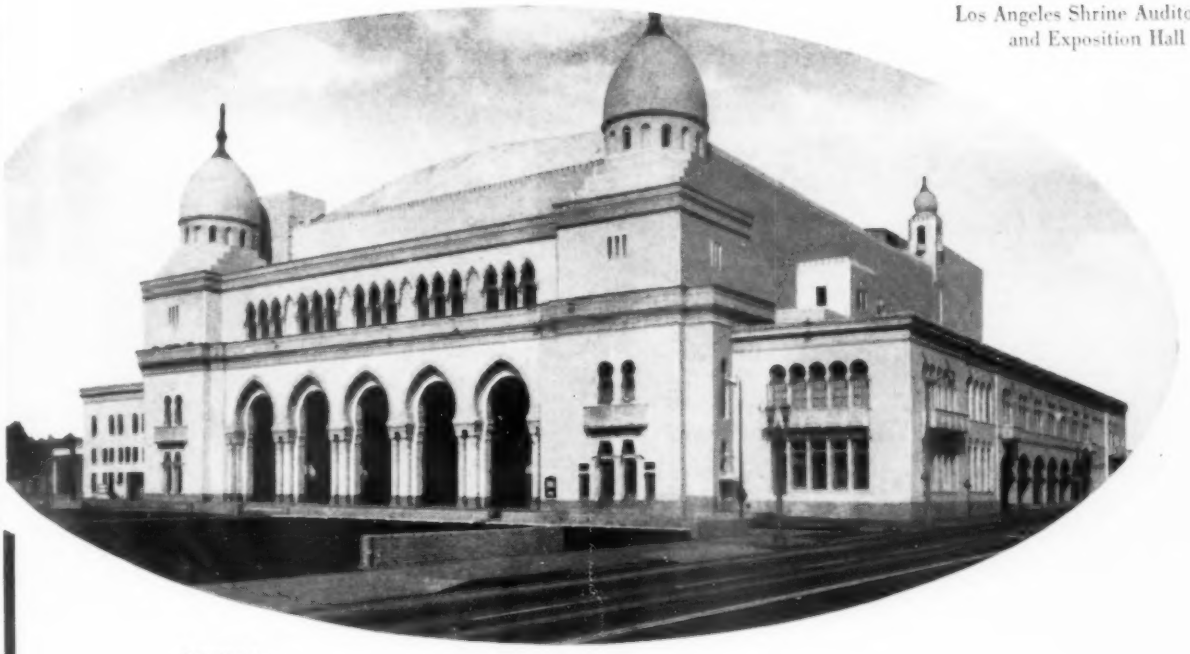

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October 1954 Issue

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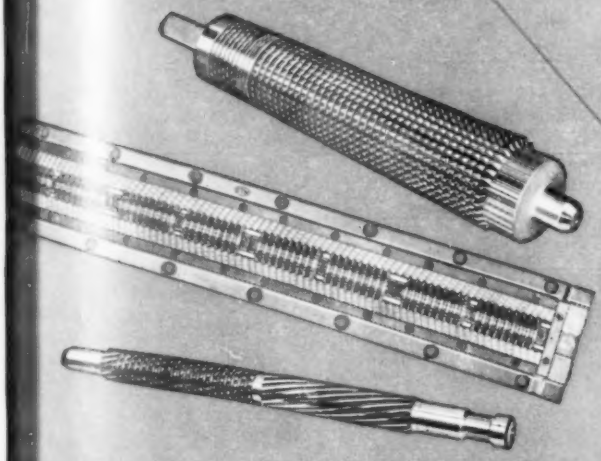

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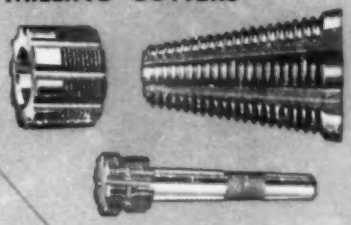

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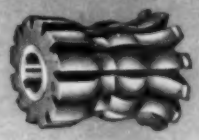

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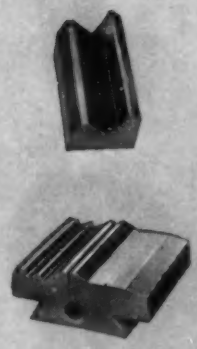

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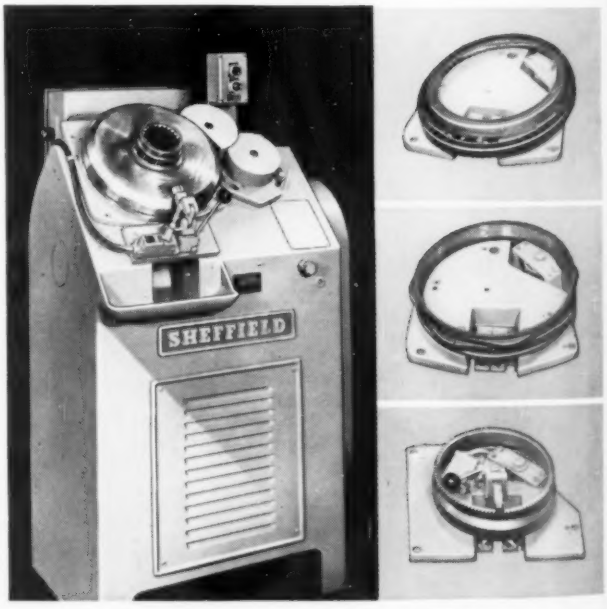

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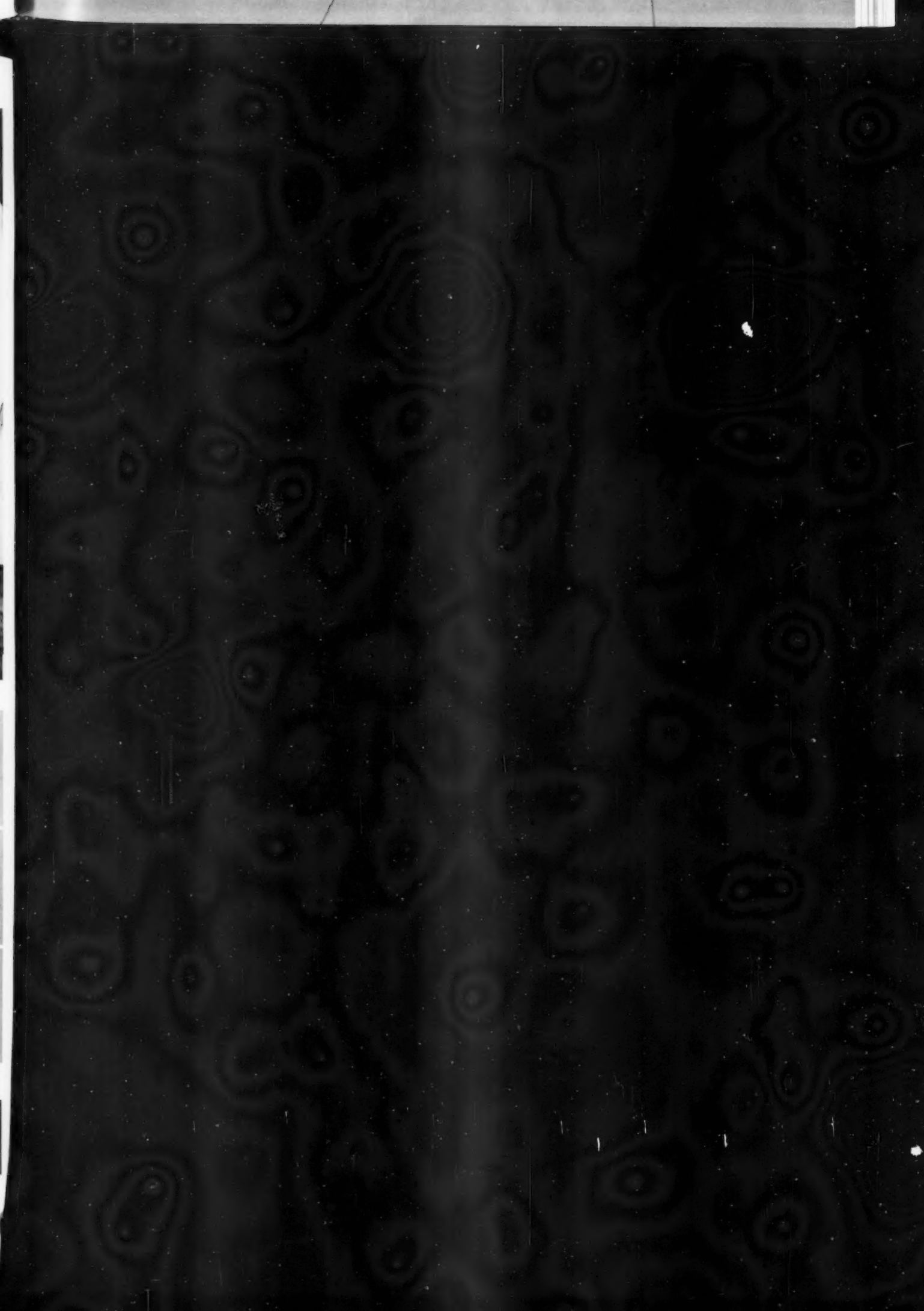
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